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Green Supply Chain Management

A Study of Green Supply Chain Management within the pulp and paper industry

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Abstract

The objective of this thesis is to create a framework that can be used by supply chains, in particular supply chains from the pulp and paper industry, to identify internal strengths and weaknesses and external opportunities and threats to develop environmental strategies.

To identify which questions to use in the environmental strategy framework, we first identified the environmental picture which the pulp and paper industry is facing. We then used this and the theory of green supply chain management, to find out how the non-integrated supply chain NORTØMMER, Norske Skog and IKEA, has become greener, and compared it with the integrated supply chain, UPM. Our findings show that there is an increasing focus on reducing greenhouse gas emissions in the industry, but there is still a lot work that needs to be done. Lastly, we therefore present an environmental strategic framework to illustrate which strategic options this particular supply chain has that can make them greener. The general environmental framework presented can be used as a strategic tool to identify environmental strategic options for supply chains.

Preface

This master thesis is written as a part of our master degree at Norwegian School of Economics and Business Administration (NHH) in the spring semester of 2011. The thesis amounts to 30 credits, which corresponds to one semester full-time studies.

The topic was inspired by the lecture about "Green Supply Chain Management" in the course *BUS 403 - Supply Chain Management* at NHH. We have both an interest in supply chain management, and were determined to write something within this topic. Climate change and the increased focus on acting sustainable and thinking "green" have also caught our attention, and when we realized we could combine supply chain management and at the same time look closer at how the environmental focus is throughout a supply chain we knew this was the perfect subject for us.

Writing a master thesis has been exciting, informative, challenging, and last but not least, very interesting. We are very thankful for the feedback and encouragement we have gotten from our thesis advisor, Mikael Rönnqvist, who has been enthusiastic about the topic since we mentioned it spring 2010. In addition we also want to thank Sophie D'Amours from Universitè Laval in Quebec, Canada, for her valuable guidance and insights. Also, we want to thank Erling Bergsaker in NORSKOG for giving us a deeper insight about the forest owners in Norway.

Bergen, 17. juni 2011

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Abbreviations

APP – Asian Pulp and Paper

CEPI – Confederation of European Paper Industries

CDP – Carbon Disclosure Project

CO_2 – Carbon dioxide

CoC – Chain of Custody

COP – Conference of the Parties

EMAS – European Management and Audit Scheme

ETS – Emission Trading System

FSC – Forest Stewardship Council

GHG – Greenhouse gases

GRI – Global Reporting Initiative

GSCM – Green Supply Chain Management

GSCP – Global Social Compliance Programme

IPCC – Intergovernmental Panel on Climate Change

ISO – International Organization for Standardization

JATAN – Japanese Tropical Forest Network

JI – Joint Implementation

PEFC – Programme for the Endorsement of Forest Certification schemes

RAN – Rainforest Action Network

RRR – Recovering, Reusing and Recycling

SCA – Svenska Cellulosa Aktiebolget

SFM – Sustainable Forest Management

TCF – Totally chlorine free

TMP – Thermo-mechanical pulping

UNEP – United Nations Environmental Programme

UNFCCC – United Nations Framework Convention on Climate Change

WMO – World Metrological Organization

WWF – World Wildlife Fund

1. Introduction

In 2010 the world's greenhouse gas emissions was the highest ever in history. The implications this will have is still unknown, but research done leaves no doubt that the climate changes we are facing today is a consequence of the increased amounts of gases that circulates in our atmosphere due to increased human activity following the industrialization. If the amount of emissions continues to increase, the middle-temperature of the earth will be higher than what is sustainable. Researchers are saying that if the global middle-temperature rises with more than 2 degrees Celsius until 2100 there is a large potential for "dangerous climate change" (Harvey, 2011). This may cause lack of food and water in areas that today is inhabited, while other areas bloom. The expected consequences of climate change is that it will cause a more uneven distribution of the world's resources than what is the case today, and thus leading to mass migrations and conflicts.

Clearly there is a need for action to be made. First in 1972 the environment and sustainability became a topic on the international policy arena, as the United Nations Environmental Programme (UNEP) was established. Since then it has inspired and encouraged governments and private organizations to become more environmentally conscious. Several initiatives have been started, environmental organizations established and new technology invented in the continuous work to improve the world's environment. The term sustainability seems to be on everyone's lips, and just by searching for the term "sustainable" on Google, one get 129 million hits.

The World Commission on Environment and Development's report *Our common future* is often cited for its definition of sustainable development as "Development that meets the needs of the present without compromising the ability of future generations" (Report of the World Commission on Environment and Development, 1987). Sustainability covers three aspects: economic, environmental and social responsibility. Companies including sustainability in their strategy have measures in place in order to improve the company in respect to all three aspects.

The pulp and paper industry is of particular interest when it comes to tackling climate change, as its main raw material is a natural resource that have proven to be a vital piece in the world's climate puzzle. Just small shares of extra gas in the atmosphere disrupt the natural balance. The forest industry is a large, energy consuming industry, and depending on trees as a raw material. The production process itself, due to intensive energy consumption, leads to

high levels of greenhouse gas emissions. In addition, deforestation releases large amounts of carbon dioxide in the atmosphere. In the tropical forests 13 million hectares of forest per year of is removed, which is equivalent to 36 football fields per minute (WWF Brief, 2010). To put this in a perspective, deforestation and forest degradation is responsible for nearly 20 per cent of the global greenhouse gas emissions, which is more than the entire transportation sector, and second only to the energy sector (UN-REDD Programme, 2009).

Because of the impact the pulp and paper industry is assumed to have on climate change, pressure has been put on the participants to become more sustainable in all of its operations. We have been studying some of the participants in the industry, with the main focus on the non-integrated European supply chain consisting of NORTØMMER, Norske Skog and IKEA. According to The Carbon Disclosure Project's Supply Chain Report (2011) 50 per cent of an average corporation's emissions are from the supply chain rather than within its four walls, and it is therefore of importance to look at the entire system. Thus, our study focuses on what a supply chain system as a whole actually does in terms of the environment, and in particular when being non-integrated. The reason why a non-integrated supply chain is interesting is because a study on a non-integrated supply chain in terms of environmental efforts has not been done before, even though fully integrated supply chains are not as common. Previous studies have mainly focused on theoretical approaches to green supply chain management for integrated supply chains.

In this particular non-integrated supply chain the raw material is wood and the final product is the IKEA catalogues. Since wood is used to produce several different end products, this is considered a divergent supply chain. With this study we hope to give some new insights as to what the different businesses along a supply chain does, and how the system as a whole functions in terms of becoming greener. To be able to say something about the non-integrated supply chain's degree of environmental action, we had to compare it with another supply chain within the industry, and therefore chose to look at the European company, UPM, who has a more integrated supply chain for their paper production.

We looked at the environmental aspect of sustainability when studying both supply chains, and are thus using the term "green supply chain". The supply chain is a system in place in order to transform the raw material into a final product. Green supply chain management (GSCM) is about making the entire supply chain more environmental sustainable. Companies may choose to adopt GSCM for many different reasons: one may be forced due to laws and

regulations, one may use GSCM to differentiate oneself in a competitive industry by being environmentally friendly and lastly one might need to implement GSCM to stay competitive if your competitors already have adopted GSCM.

Thus, this master thesis will address the question of how this non-integrated supply chain system is becoming greener, compared with an integrated supply chain and best practices in the industry. Our intention is to provide a general framework for a supply chain system that can be used to find which strengths and weaknesses they have internally and which opportunities and threats it faces externally in terms of the environment. We have developed a set of questions that should be asked to identify the relevant characteristics. The questions cover the different aspects within GSCM which we mention in our case studies. The findings can then be used to make a strategy with the intention of making the supply chain greener. Since we decided to base our master thesis only on public available information, the framework provided has a simplistic view and do not cover all aspects of the supply chain nor GSCM. However, by using this framework a company can more easily generate more questions to be able to map its own strategic options.

To gain an understanding of GSCM, and how a system like the one we are studying works it is necessary with some background information. Our thesis is mainly concerning the pulp and paper industry, and hence all theory is focused toward this. To gain a theoretical context we have started by describing relevant theories in chapter two, such as supply chain theory, a closer description of GSCM, and the theory behind a SWOT and TOWS analysis. Then, we present a framework giving an understanding of how the continuous work towards worldwide environmental policies is proceeding, and a description of important organizations that are influencing the companies we are looking at in chapter three. Also included in this chapter is a description of the three main certifications used internationally in the forest industry and an explanation of greenhouse gases and the implications of greenhouse gas emissions today. In chapter four we will give a brief description of the situation in the forestry and paper industry today, seen from an environmental perspective. To give an insight of the companies we are studying, chapter five and six presents the non-integrated and integrated supply chains.

In chapter seven we will present our case studies including first the non-integrated supply chain, followed by the integrated supply chain. These case studies will take a closer look at six different parts of the supply chain and what is done at the different parts in terms of the environment. To sum up and compare with other companies in the industry we have a general

discussion at the end. Next we present in chapter eight a deeper insight in cooperation and reporting systems within the supply chains.

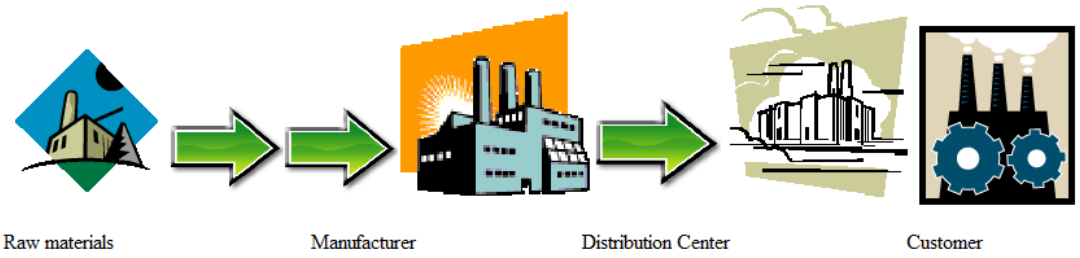
Chapter nine is the main part where we present the framework meant for companies to use in order to identify key characteristics with its supply chain system that are influencing its greenness. We are asking concrete questions about the different parts of the supply chain in terms of GSCM and answering them seen from the non-integrated supply chain's perspective. To sum up this supply chain's strength, weaknesses, opportunities and threats we use a SWOT analysis. In the end we conduct a TOWS analysis which is a practical tool that can be used to identify strategic options that can be followed to become greener. These suggested strategies are a simplistic answer, but is supposed to provide our opinion seen from an external point of view on which measures they could put in place to improve their environmental profile. In chapter ten we present our concluding remarks.

2. Theoretical Framework

2.1 The Supply Chain

The Supply Chain is the movement of materials as they move from their source to the end customer. According to Christopher (2005) the Supply Chain produce value in the form of products and service to the end customers through different processes and activities, which are performed by the network of organizations from the upstream and downstream linkages. Often a supply chain also is described by the term *value chain*, which reflects the concept that value is added along the chain (Stevenson, 2009, p. 513). The network, process and activities may consists of suppliers, purchasing, manufacturing centers, warehouses, transportation, distribution centers, and retail outlets, as well as raw material, work-in-process inventory, and finished products that flow between the facilities. A simplified example of a supply chain might look something figure 2.a:

Figure 2.a: Supply Chain

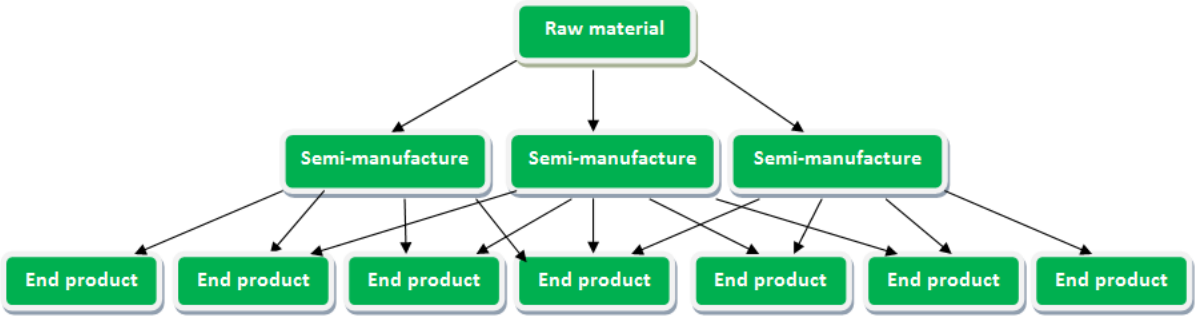


Source: Supply Chain Definitions.com, 2011

Here you can see how information, materials and services flow from raw material suppliers through manufactures and distribution centers, to the end customer.

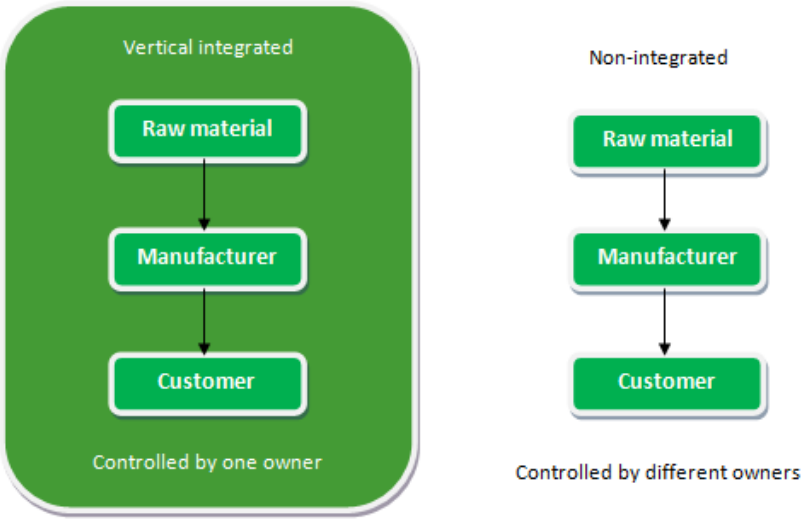
According to Stevenson (2009) every organization is part of at least one supply chain, but many are part of multiple supply chains. One type of a supply chain is a divergent supply chain. A divergent supply chain at the process level has typically one or few raw materials, which later downstream in the supply chain, may turn into several thousand different types of end products and products with quality differences.

Figure 2.b: Divergent Supply Chain



The degree to which a firm owns its upstream suppliers and downstream buyers is referred to as vertical integration (Clinton, Manna & Marco, 2008, p. 47). A hundred per cent vertical integrated supply chain has only one owner, and consequently a non-integrated supply chain is controlled by different owners.

Figure 2.c: Supply Chain Integration



With a higher degree of vertical integration, it is easier for the units to collaborate and share information. Information sharing is important to achieve an efficient supply chain. The manufacturers can with information sharing easier predict demand and reduce lead time if they are able to use retailers' sales data. They can also better control variability in the supply chain and with that, reduce inventory and smooth out production. Horizontal cooperation, such as price fixing or market sharing, would be a violation of competition law and therefore illegal.

2.2 Green Supply Chain Management

Green supply chain management (GSCM) has emerged the last few years as a result of enterprises wanting to make their businesses environmentally sustainable. GSCM covers every stage in the supply chain from product design, procurement, sourcing and supplier selection, manufacturing and production processes, logistics and the delivery of the final product to the consumers, along with the end-of-life management of the product (Emmet & Sood, 2010, p. 4). Altogether, these stages cover: upstream, downstream, within the organizations and the connecting logistic processes.

Figure 2.d: Green Supply Chain Management within a Supply Chain

Source: Carlson & Lingl, 2008, p. 29

According to Emmet & Sood (2010), GSCM can be implemented throughout the supply chain's four different areas as mentioned above. GSCM can be implemented at the upstream activities by using green design, green procurement, and evaluation of suppliers' environmental performance. Downstream, GSCM can be implemented by introducing any recovery and recycling opportunities after the product has provided its utility and also the disposal and sale of excess stocks. Within the organizations, GSCM includes those activities related to green design, green packaging and green production. Figure 2.d is an illustration on how and where a company may adopt GSCM from suppliers to the end customer.

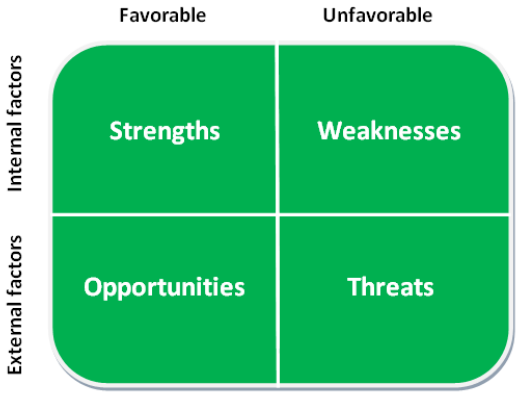
There are also other reasons for why companies decide to adopt GSCM. First of all, the government may impose laws and regulations to promote a sustainable environment on the different industries. Secondly, the rivalry between companies is very high in the business world today. A company can therefore differentiate themselves and make their products attractive for their end customers by being environmentally friendly. In addition, if the competitors already have adopted GSCM, it might be necessary for the company to implement GSCM to stay competitive.

2.3 SWOT and TOWS

The SWOT analysis is used to identify an organization's strengths, weaknesses, opportunities and threats. Strengths and weaknesses focus on an organization's internal conditions, while opportunities and threats focus on its external environment (Clegg, Kronberger & Pitsis, 2005). The two first concepts can include skills, expertise or technological know-how, particular organizational resources, competitive capabilities or potential advantages. The latter two typically look at the external competitive environment of the organization (Burtonshaw-Gunn, 2008).

The SWOT framework is a helpful tool for generating a summary of a strategic skill. It provides the organization a clear indication of its performance and what areas it needs to address. In other words, it can help organizations to implement appropriate strategies that can convert external threats to opportunities, and internal weaknesses to strengths. According to Learned et al (1969, referenced in Clegg, Kronberger & Pitsis, 2005, p. 417) the SWOT framework is a frequently used tool because of its simplicity and straightforwardness, which in turn makes it easy to use. The SWOT analysis is summarized in the figure below:

Figure 2.e: SWOT



After a SWOT analysis, a TOWS Matrix analysis can be conducted. The TOWS Matrix, which is illustrated below in figure 2.f, is a relatively simple tool for identifying strategic options. By matching external opportunities and threats with internal strengths and weaknesses one can recognize how to best take advantage of the opportunities and minimize the impact of one's weaknesses and protect oneself against threats. In other words, the matrix helps one identify different strategic alternatives.

Figure 2.f: TOWS Strategic Alternative Matrix

Source: Mind Tools, 2011

Under the Strength – Opportunity classification, the organization needs to classify its opportunities and then identify its strengths which can help to maximize and take advantage of the opportunities. For instance, if a company wants to enter a market where the customers are environmentally conscious, possible strengths that could help it penetrate the market might be that the organization is environmentally friendly and produces environmentally friendly products.

The Strength – Threat category identifies what strengths the organization can use to eliminate or minimize its external threats. For example, a potential threat to an organization might be loss of market share to a new environmentally friendly competitor in the market. The organization could then try to protect its position by developing a market campaign which emphasizes its superior environmental profile and products.

With the Weakness – Threat strategy, the organization attempts to minimize its internal weakness in addition to prevent external threats. In other words, the organization tries to identify ways to protect its business. For example, the organization might try to enter into a strategic alliance or merge with one of its competitors to protect its operations from a rival organization. In addition, the organization has also the option to withdraw from a market or suspend operations.

Under the Weakness – Opportunity strategy, the organization wants to use its external opportunities to eliminate or minimize its internal weaknesses. To illustrate, consider an organization that faces rising costs due to new legislations in its home country. In addition, it has identified an attractive opportunity to outsource some of its operations to another country where this legislation does not exist and the costs are therefore also lower. This outsourcing prospect will then reduce the organization’s threat of rising cost due to the new legislation.

3. The Environmental Picture

3.1 History

In 1972 after the UN conference in Stockholm, the UN Environmental Programme (UNEP) was established. UNEP has since then provided leadership and encouraged partnerships to care for the environment (UN Global Compact, 2011). They have had an important role in the design of both legally and non-legally binding agreements.

In 1988 they saw the need for a body that could provide the governments of the world with a clear scientific view on the sciences of climate change, and therefore The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and UNEP. IPCC is open for all United Nations member countries and its role is "..to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.." (IPCC, 2011*a*). One of the most important principles for IPCC is to be policy-neutral, but not policy-prescriptive in their reports. The first IPCC Assessment Report came in 1990, and turned out to be an influential report that for the first time highlighted the importance of introducing climate change as a topic on the international political platform (IPCC, 2011*a*).

This report turned out to be of great relevance at one of the most important and influential conferences held that concerns the global environment. At the "Earth Summit" conference held in Rio de Janeiro in 1992, especially two important decisions were agreed on. Firstly, Agenda 21 was agreed on after long negotiations and with several compromises. Agenda 21 is a detailed plan with action steps to be taken globally, nationally and locally to become more sustainable (Division for Sustainable Development, 2009). The action plan have influenced both governments and the private sector in setting more defined action plans and to start up organizations that deal with environmental issues.

Secondly, The United Nations Framework Convention on Climate Change (UNFCCC) was passed and put into force in 1994, after influence from the first IPCC report that unveiled the importance of climate change as a topic deserving a political platform among countries to tackle its consequences (IPCC, 2011*a*). The UNFCCC is a framework for intergovernmental efforts to tackle the challenges posed by climate change (UNFCCC, 2011*a*). The creation of this convention has led to increasingly international cooperation on fighting climate change,

and has inspired establishments of several international organizations that concerns environmental issues. Governments share best practices and policies, and try to a find strategies on how to become more sustainable and how to adapt to the climate changes and the consequences it have for different regions.

The supreme body of the convention is the "Conference of the Parties" (COP), which is an association of all the countries that are Parties to the Convention (UNFCCC, 2011*b*). The COP is responsible for keeping international efforts to address climate change on track, and arranges a meeting annually for its members, known as COP-meetings. In November 2010 the latest COP-meeting was arranged in Cancun, which was the 16th meeting held by COP.

The first addition to the UNFCCC came with the Kyoto Protocol in 1997 (UNFCCC, 2011*c*), and the Second Assessment Report from IPCC provided key input to the protocol (IPCC, 2011*a*). The Kyoto protocol became the first intergovernmental legally binding agreement concerning environmental issues, and commits the countries that signed the agreement to a five per cent reduction of greenhouse gas emission in per cent of 1990 levels over the period from 2008 – 2012 (UNFCCC, 2011*c*). It has been a heavy pressure on the industrialized countries, as they are responsible for a large fraction of the greenhouse gas emission. The Kyoto protocol encourages the country to mainly meet their targets by national measures, but opens as well for three market-based mechanisms that are supposed to stimulate green investments and make the countries meet their targets in a cost-efficient way. These mechanisms are emission trading, clean development mechanism (CDM) and joint implementation (JI) (UNFCCC, 2011*c*). The protocol does not specify how much of their emission reductions the countries are required to make domestically, except saying that it should be a considerable amount. By 2011 192 countries and the EU have signed the protocol. The protocol only regulates the emissions from 37 countries. The USA and the developing countries have not signed the protocol. Altogether the emissions covered by the Kyoto-protocol are responsible for 30 per cent of total greenhouse gas emissions, while the US and the developing countries accounts for 70 per cent (Statistisk sentralbyrå, 2010).

The Kyoto Protocol as it stands today will not have any great impact on reducing emissions for the period this version of the protocol is effective, 2008 – 2012. While the 37 countries that are subject for regulations due to the protocol shows a slow growth in emissions, USA and the developing countries shows a large growth in emissions (Statistisk sentralbyrå, 2010). The discussions on new emission reduction requirements have started for the new agreement that needs to be ready in 2012. If the requirements are stricter than the ones from the current

agreement, and if the US as well as developing countries also agree to take on some reductions, then there is a hope of reducing total emissions globally (CICERO, 2010).

IPCC continues to provide their Assessments Reports on a regular basis, which is regarded as the most important foundation for the international climate policies (Klima- og Forurensningsdirektoratet, 2011*a*). In 2007 IPCC and Al Gore received the Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for measures that are needed to counteract such change." (The Nobel Peace Prize, 2011).

3.2 Important Organizations and Initiatives

As mentioned above the UNFCCC, Agenda 21 and other UN conventions have led to the development of different initiatives and organizations. Many business leaders have been inspired to form networks and initiatives that work together towards common goals, and seek to influence international environmental negotiations. There are both organizations and initiatives that are important and influential in the environmental discussion.

3.2.1 UN Global Compact

The UN Global Compact was established in 2000 by UN Secretary-General, Kofi Annan. The Global Compact is a strategic policy initiative for businesses that are committed to aligning their operations and strategies with ten universally accepted principles in the areas human rights, labor, environment and anti-corruption (UN Global Compact, 2010). The principles concerning the environment are not especially concrete, but more a general advice and encouragement on how businesses should think when forming their strategy, with an environmental focus.

Members of the UN Global Compact share knowledge and resources that will make their activities more sustainable, and the Global Compact provides them with a practical framework to help develop strategies that make them better at meeting the complex risks and opportunities that they stand upon today. The Global Compact is the largest voluntary corporate responsibility initiative in the world, with over 8 700 corporate participants and other stakeholders from over 130 countries (UN Global Compact, 2010).

3.2.2 Carbon Disclosure Project (CDP)

The Carbon Disclosure Project, an independent not-for-profit organization, is the leading global organization addressing carbon emissions reduction. They work with shareholders and

corporations to disclose the greenhouse gas emissions of major corporations and have today the largest database of primary corporate climate change information in the world (Carbon Disclosure Project, 2009). International agreements such as the Kyoto Protocol has proved being inefficient due to individual governments which have been reluctant to impose national limits on emissions in fear of losing big companies to nations with less strict regulatory regimes. CDP tries to solve this problem by focusing on individual companies rather on nations.

3.2.3 Global Reporting Initiative (GRI)

The Global Reporting Initiative (GRI) is a network-based organization that pioneered the world's most widely used sustainability reporting framework (Global Reporting Initiative, 2007*a*). It was formed by the non-profit organization, Ceres, with the support of the United Nations Environment Programme (UNEP) in 1997 (Global Reporting Initiative, 2007*b*). The framework is intended for voluntary use, and covers reporting guidelines for economic growth, environmental performance and social responsibility. One of GRI's goals is to make sustainability reporting just as widespread and common as financial reporting.

3.2.4 Global Social Compliance Programme (GSCP)

The Global Social Compliance Programme (GSCP) is a business-driven program for companies to build consensus on best practice in labor and environmental standards in the supply chain. Their aim is to develop a shared, global and sustainable approach for the continuous improvement of working and environmental conditions across categories and sectors in the global supply chain (Global Social Compliance Programme, 2011). This global platform will promote help build comparability and transparency between existing systems. The participating companies represent retailers and consumer goods manufactures.

3.3 Non-Profit Environmental Organizations

Maybe the most important organizations are the ones that put pressure on governments and the corporate sector continuously to make sure they are acting on their promises. These are the non-profit environmental organizations, like Greenpeace and World Wildlife Foundation. Often it is these ideal organizations that shed light on company's misbehavior and hence put enough pressure on them to change their behavior as they are more action-oriented. These organizations run large campaigns which often lead to a change in behavior and more consciousness around environmental issues. Examples of successful campaigns these

organizations have accomplished are: to save forest areas, stop illegal logging, stop using destructive methods for tuna fishing and so on.

3.3.1 World Wildlife Fund

The World Wildlife Fund (WWF) was founded 50 years ago by a small group of concerned scientists, naturalists, and business and political leaders (WWF, 2011*a*). They wanted to save the Earth's wildlife from extinction, and their mission is the conservation of nature. WWF work to preserve the diversity and abundance of life on Earth and the health of ecological systems (WWF 2011*b*). Today WWF works in 100 countries and is the world's leading conservation organization with close to 5 million members globally. As forests have vital role in the fight against climate change, WWF is working to manage almost 540 million acres (WWF 2011*c*) of forest in a socially, environmentally and economically responsible manner.

Paper products are crucial in today's society. However, without changing current paper consumption and production practices, the growing demand for paper threatens the Earth's natural forests and endangered wildlife. To satisfy our paper demand, businesses in the paper industry are contributing to unsustainable logging which accelerates climate change and leads to wildlife loss. These practices also affect the people who depend directly on forests. To help reverse this trend, WWF established the Pulp and Paper programme (WWF for a living planet, 2011*a*) which engages with stakeholders to encourage sustainable forestry, clean pulp and paper manufacturing, and promote responsible paper consumption.

During its 50 years of existence, WWF have participated in many successful projects. In 1992 WWF played a critical role in the first international agreement on climate change, UNFCCC, and five years later they were involved in bringing about the Kyoto Protocol. In 1999 they helped save the Congo Basin rainforest where more than ten per cent is now protected and after several years of WWF's involvement in Russia's commercial forests a quarter of the area were certified by FSC in 2010 (WWF Annual Review, 2010, p. 9). WWF also runs projects with companies, helping them with a sustainable development.

3.3.2 Greenpeace

In 1969 the US announced the detonation of a nuclear bomb in the Bearing Sea at an island which was inhabited by 3000 endangered sea otters (Greenpeace, 2009). This made environmental organizations and activists in Canada react. A few activists chartered a fishing boat in 1971, renamed it Greenpeace, and started their journey towards the island Amchitka

with a hope of stopping the testing. The boat was stopped before it reached the island, and the US detonated their bomb, however their voice had been heard as they caught the public's interest with their campaign and later that year the nuclear testing at Amchitka ended (Greenpeace, 2009). After this campaign Greenpeace was decided to be the organization's name, and since then they have ran numerous campaigns all over the world motivated by the vision of a green and peaceful world.

Greenpeace have their headquarters in Amsterdam, Netherland, as well as offices in 41 countries around the world. As of January 2009 2.9 million people are members of Greenpeace worldwide, paying a membership fee that keeps the organization going (Greenpeace, 2011*a*). Greenpeace is an independent organization, and to ensure their absolute independence they do not accept money from governments, companies or political parties (Greenpeace, 2011*a*).

Their victories includes getting Xerox, the large photocopy company, to stop buying paper from Stora Enso because they were cutting down one of Europe's last remaining ancient forests (Greenpeace, 2011*b*). Quite recently several years of tough campaigning finally paid off for Greenpeace and eight other environmental groups, when the Canadian Boreal Forest Agreement finally was signed by the Forest Products Association Canada (Greenpeace, 2010). This is one of the biggest and most ambitious forest deals ever agreed on, as it includes large-scale protection of wilderness areas in Canada's Boreal Forest, covering 72 million hectares (Greenpeace, 2010). These two victories are just two out of a long list of victories Greenpeace have achieved as a result of their enthusiastic and tough campaigning.

3.4 Greenhouse Gas Emissions

Changes in the climate over the years have increased the focus on human-induced activities that influence climate change, which is also the focus of the IPCC. Their comprehensive research has proven that the climate has changed dramatically since the industrial revolution, and that the changes to a large extent are caused by human activities (Miljøstatus, 2011*a*). The explanation for the global heating is said to be caused by changes of the amount of certain gases in the nature, which have influenced the natural flow of these gases, also named greenhouse gases (GHG).

Greenhouse gases are released through different processes like manufacturing, transportation and electricity generation which accumulates in the atmosphere where they act like a heat-

trapping blanket that is warming the earth's climate (Carlson & Lingl, 2008), of which their name arises from. The Kyoto Protocol has emission reduction targets for altogether six gases that are considered greenhouse gases, one of them being carbon dioxide (CO_2). Carbon dioxide is assumed to be the main contributor to climate change and it is mainly released from burning fossil fuels, but also as a result of deforestation (Carlson & Lingl, 2008). Its large contribution is not because of its impact per unit, but due to the large volume being produced of the gas. Carbon dioxide is stored naturally in the nature, and over millions of years natural carbon flows and exchanges have developed with the natural evolution. Forests contain a significant global carbon stock, as the total amount of the forest ecosystem is estimated to be 638 Gt in 2005 (UNFCCC Fact Sheet, 2011), which is more than the amount of carbon in the entire atmosphere. IPCC have proven that human-activities when using land and forests have caused a steady increase in the amount of carbon released in the nature. Over the last 150 years the atmospheric concentration of carbon has increased by 28 per cent (IPCC, 2011*b*).

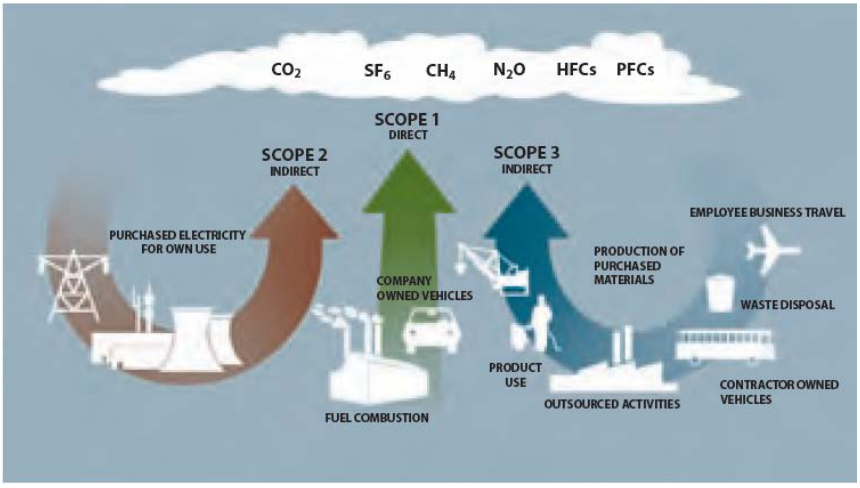
During the decade of the 1990's, deforestation in the tropics and forest re-growth in temperate and boreal zones remained the major factors contributing to emissions and removals of greenhouse gases respectively (UNFCCC, 2011*d*). In 2000 the IPCC published a Special Report called "Land Use, Land-Use Change and Forestry", which looks at the long-term consequences of human activities influences on the carbon circulation in the nature, and possible measures that can be taken. The reduction of fossil fuels is an obvious and important measure, but they also point out that it is possible to take advantage of the fact that carbon dioxide can accumulate in vegetation and soils in terrestrial ecosystems. Sustainable forest management is therefore necessary to avoid deforestation, and instead ensure re-forestation.

The increased attention on greenhouse gas emissions following the Kyoto Protocol, have led to a demand from customers to know the environmental impact of a product or service, which is measured as their "carbon footprint". Unfortunately there is not one standard that describes how to calculate the carbon footprint of a product, but several different tools exists. A carbon footprint may range from a single number to a full life cycle analysis, and is a remarkably complex calculation. Businesses are also different; however they have some common ground that makes it possible to have general calculation tools (Carlson & Lingl 2008).

The most well-known and used accounting tool for businesses is the Greenhouse Gas Protocol, which is a partnership between World Resource Institute and World Business Council for Sustainable Development. The Greenhouse Gas Protocol provides an accounting

framework for nearly every greenhouse gas standard in the world (Greenhouse Gas Protocol Initiative, 2011), and they also provides some practical tools to help calculating emissions. For some industries member organizations have created their own tool, based on the situation in that industry. The Confederation of European Paper Industries (CEPI) has developed a calculation tool for their members, so that the calculations for the paper industry are more or less based on the same grounds which will make comparison between the companies in that particular industry easier (Mensink, 2007).

Figure 3.a: Emission Scopes



Source: Carlson & Lingl, 2008

When measuring a product's carbon footprint a crucial matter is which emissions to include from the different processes that lead to the end-product. The Greenhouse Gas Protocol describes three different emission scopes to make it more readily understood which emissions are included in the inventory. This prevents double-counting of the same emission by different organizations (Carlson & Lingl 2008, p. 21). Scope one includes the direct emissions caused by the organization that comes from company owned or company controlled sources. The indirect emission that is termed under scope 2 includes purchased electricity, heat or steam. According to the Greenhouse Gas Protocol scope one and two is the minimum to be included in the organizational inventory. Scope three is the indirect emissions that come from other sources, like transportation of goods in vehicles owned by third parties or outsourced activities, and is an optional scope to include. However, the most correct calculation of the carbon footprint will be given by including all three scopes.

Although measuring a carbon footprint seems like an easy process in theory, obtaining the correct numbers for the calculation is sometimes a very complex and difficult task. If the

supply chain for example is divergent, there are several processes that are interconnected leading to several different products. The exact amount of carbon emissions caused by one product through the different production processes in a divergent supply chain is therefore almost impossible to measure. The trend today towards an increased amount of choices for the customers implies larger difficulties with measuring carbon footprints. As we see different types of products being produced from the same raw materials going through the processes along the supply chain the difficulties with measuring carbon footprints increases. When just having one product it is easy, as the total resource consumption and hence the emissions can be easily measured per product.

As mentioned, there are six different greenhouse gases that are covered in the Kyoto-protocol, but it is mainly carbon dioxide that is mentioned. This is because CO_2 is chosen as the reference gas by IPCC, and one therefore calculates the CO_2-equivalent of the different gases (GHG Management Institute, 2010). The CO_2-equivalent is a metric system used to compare the emissions from the different greenhouse gases based on their Global Warming Potential. The gases do not have the same effect on global warming, and their lifespan in the atmosphere varies from just a few years to several ten-thousands of years (Miljøstatus, 2011*b*). By having the same metrics for the different gases, it is easier to measure an emission's total warming potential, and makes it comparable to other emissions.

3.4.1 Three mechanisms for emission reduction

Since it is hard for the emission-reducing countries to meet their targets by only reducing emissions through national measures, three mechanisms is offered as additional means to reaching the targets. These three are emission trading, clean development mechanism (CDM) and joint implementation (JI). The mechanisms are supposed to make it more cost-efficient to reduce emissions and to also stimulate green investment. The UN has given each country that is committed to reduce emissions an emission quota that limits the amount of CO_2 emissions that they can have. If they are not able to reduce emissions nationally they can put different measures in place. The emission trading system has established a global carbon trading market, where quotas are sold and bought at market price, determined by supply and demand (UNFCCC 2011*d*). One quota is equivalent to one tonne CO_2. The other two mechanisms, CDM and JI, are supposed to feed the carbon market (UNFCCC 2011*e*). Countries with emission limitations can invest in emission reducing projects in developing countries through the CDM (UNFCCC 2011*f*). The third option is to earn emission reduction targets by

participating in an emission reduction or removal project in another country that has emission limitations, through the joint implementation mechanism (JI). This enables industrialized countries to carry out joint projects with other developed countries to reduce emissions (UNFCCC 2011*g*).

The emission quotas have a value since the supply is limited, and as more demand quotas the value will increase, and hence it might be more profitable to invest in emission reduction means instead. This is the thought behind the system, as it is supposed to help stimulate sustainable investments. There is not yet developed a global trading system, and the largest one is EU's Emission Trading System (EU ETS), which Norway also is a part of. The over 10 000 major installations that is a part of the EU ETS each have a certain amount of emissions allocated to them, and if they pollute more they will have to buy new quotas. Unfortunately, the emission trading system is far from perfect. Firstly, the object being traded is intangible, and a subject for fraud. This endangers the systems function and credibility. However, the main problem seems to be that certain large players in the system have gotten too many credits. This leads to a smaller demand for quotas in the market, and hence a low price. Another critical issue is that since there is no global emission trading system, heavy polluters can just move their business elsewhere to countries without proper CO_2 schemes, and hence the effect they have on the global greenhouse gas emissions is not accounted for. These issues are still a problem, and the emission trading system is not yet serving its mission. So far the system has not contributed to the necessary carbon cuts or the technological innovation that was planned for. In Norway, the numbers after three years of emission trading and carbon quotas shows that the industries are not even using the entire quota that they have received (Statistisk sentralbyrå, 2011*a*).

3.5 Environmental certifications

Customers have to a larger extent started to demand environmentally friendly products. In addition to the customers, also national laws and regulations requires companies to follow environmental standards. Companies can obtain certain certifications that are offered by different organizations in order to satisfy both governmental and customer requirements. To achieve a certification there are different requirements that companies have to fulfill, and some prefer to have several certifications in order to reach a larger customer group.

3.5.1 International Organization for Standardization (ISO)

International Organization for Standardization (ISO) is the world's largest developer and publisher of International Standards. ISO is a network of the national standards institutes of 160 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system (ISO, 2011). ISO is a non-governmental organization that forms a bridge between the public and private sectors (ISO, 2011). Their members are either part of the governmental structure of their country, or have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. Because of this, the standards and solutions presented by ISO unite both the needs of businesses and the broader needs of the society.

3.5.2 Forest Certifications

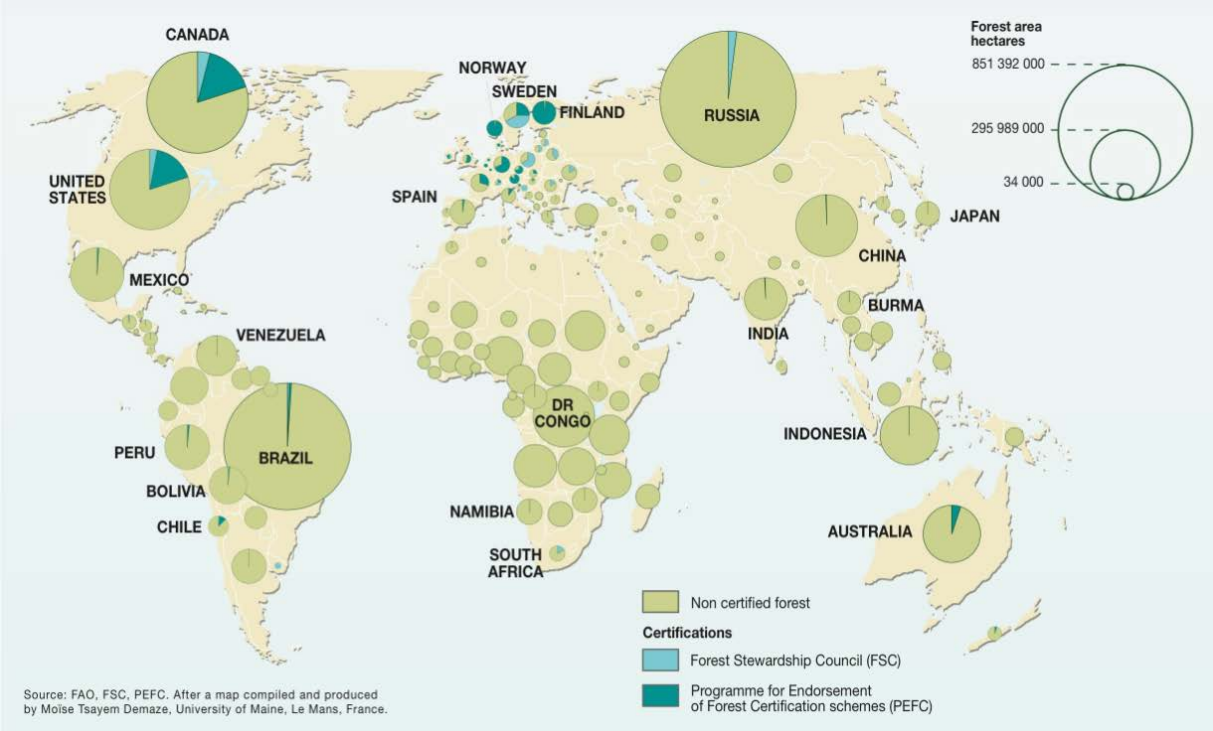
There are two major international systems for forest certification: the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification schemes (PEFC). Both are used by community and family owned forests and large landowners and/or industrial operations. The purpose of the forest certification schemes is to ensure sustainable forest management, and thus to get certified companies have to follow certain requirements for forest management. These systems have similarities, but they also have differences that are considered important by their respective constituencies. According to Sustainable Procurement of Wood and Paper-Based Products (2007), it seems like environmental organizations tend to prefer the FSC, while landowners and tenure holders tend to prefer PEFC. Some forest owners still choose to have both, as that will increase their market. A difference between the two standards is that PEFC is regarded as less strict than FSC. However, CEPI is of the opinion that the main difference between FSC and other certifications is publication and participation, and asks “In the end of the day, what is forest certification supposed to be about: forest management or marketing?” (CEPI Q&A, 2008).

The environmental organizations are nevertheless quite harsh in their reviews of the PEFC standard, and accuse the PEFC of being more like a trade organization lacking “crucial elements of credible forest certification systems” (Credible Forest Certification, 2006). But there have been incidents showing that the FSC-standard is not necessarily bulletproof either. In 2007 the Asian Pulp and Paper (APP) were planning to start using the FSC-logo on their products, as they satisfied the requirements. This made several environmental organizations react, since APP is criticized for its lack of good forestry practices in terms of environmental

aspects. The fact that a company such as the APP manages to qualify for FSC have made many point out that the FSC standard is not as strict as they say they are. In the beginning FSC required that 100 per cent of the wood used in a product was harvested by sustainable methods. However, this did not appeal to many companies, and few requested this certification. This made FSC adjust their requirements, and hence they now only need 50 per cent of the wood used in a product to be harvested by sustainable methods (Wright & Carlton 2007). This led to a boom of FSC-certifications and also getting large corporations like IKEA to only recognize this certification.

Although the focus on forest certification is increasing, today only 7 per cent of the world's forest is certified (Sustainable Procurement of Wood and Paper-Based Products, 2007). There are large regional differences, and as the figure underneath shows, most of the certified forests are in Western Europe and North America. In Norway most of the productive forest is certified after the PEFC-standard in a combination with ISO 14001 (Nordic Family Forestry, 2011).

Figure 3.b: PEFC and FSC Certifications around the World



Source: UNEP/GRID-Arendal, 2009

There are two types of certifications, Sustainable Forest Management (SFM) and Chain-of-Custody (CoC). Forest management is certifying the forest property and the operations taking place there as well as the products coming from that property. Being CoC-certified means that the entire value chain from the forest to the final customer is certified (PEFC, 2011*a*).

Programme for the Endorsement of Forest Certification (PEFC)

PEFC is an international non-profit, non-governmental organization and is the world's largest forest certification system. The certification system was founded after the initiative by forest owners. Their standards seek to transform the way forests are managed globally and locally, to ensure Sustainable Forest Management through independent third-party certifications (PEFC, 2010*a*). PEFC is an umbrella organization that works by endorsing national forest certification systems developed through processes with different stakeholders. This ensures that the certifications match the conditions locally (PEFC, 2010*b*).

PEFC Norway's objective is to promote sustainable forest management by making certification of forest properties and forest products available. Norwegian representatives were active in establishing the PEFC council and developing the PEFC system. Norway was one of the nations that became members from the beginning, and their membership was approved in May 2000. In the PEFC system there is a national standard for sustainable forestry established in every member country. In Norway, the Living Forest Standard was finalized in 1998, and since many of the participants creating the PEFC council had taken part in the creation of the Living Forest Standard, it was natural that this became the forest management standard in Norway (PEFC, 2011*b*), in a combination with the ISO 14001 (SABIMA, 2011).

The Living Forest Standard was revised in 2006, and until 2010 Norway was one of the few countries in Europe that had a uniting standard that both forest owners and environmental organizations agreed on. Unfortunately, during the revision of the standard in 2010, there was a disagreement between the different members of the council, and the environmental organizations pulled out. The environmental groups that was a part of the council was of the opinion that there should be some restrictions concerning the planting of new spruce and unfamiliar species of trees, a view that the forest owners did not share (SABIMA, 2010). Although the environmental organizations no longer recognize the standard, the forest owners still follow it, as it fulfills the requirements from the government (AT Skog, 2010, p. 3). Even

so, SABIMA and the other environmental organizations claim that the standard as a system and concept is not valid anymore (SABIMA, 2011).

Forest Stewardship Council (FSC)

FSC is an independent, not-for-profit and non-governmental organization established to promote responsible management of the forest (FSC, 2011). The organization was established in the wake of the UN conference of Sustainable Development in Rio in 1992, after the initiative by several environmental organizations (Sustainable Procurement of Wood and Paper-Based Products, 2007). According to FSC their mission is "*to promote environmentally appropriate, socially beneficial, and economically viable management of the world's forests*". FSC have ten principles as an underlying guideline to reach their mission, and all national standards are derived from it.

FSC is today represented in more than 50 countries worldwide. Each country makes its own principles based on national and regional regulations, with the ten principles as a basis. In Norway environmental organizations are initiating negotiations in order to achieve a Norwegian FSC-standard (Bårdsgård, 2011). The FSC-standard is regarded as stricter than PEFC by several stakeholders, and after the revision of the Living Forest Standard stranded summer 2010, getting a Norwegian FSC-standard is of a greater importance for the environmental organizations. However, the disagreement on planting unfamiliar species in Norway still stands strong, and so far discussions around a Norwegian FSC-standard are not near an ending. Forest owners would like to plant North-American species in Norway, but WWF and SABIMA are strongly against this as they argue that it will threaten the biological variety in Norway. Although there is no Norwegian FSC-standard today some Norwegian companies is still certified with FSC as some customers require FSC-certified wood.

4. The Industry

As with the exploitation of other natural resources, harvesting has to be within certain boundaries. Wood is a renewable resource that can store carbon. This also counts for products based on wood, and these types of products are usually also recyclable. Such attributes make the forest industry highly relevant when it comes to environmental issues. However, the main challenge for the forest industry is deforestation in developing countries, which contributes to 20 per cent of the global greenhouse gas emissions (Norske Skog Annual Report 2010, p. 24). Often there is a lack of a good regulations structure in these countries, leading to unsustainable forest management. In Norway there are important regulations in place in line with international standards which the forest industry follows. Standards around the world are quite different though, and especially how the regulators follow up the forest management.

Illegal logging is a problem, especially in regions like South-America and Russia. This may lead to deforestation, the loss of biodiversity and fuelling climate change because of the loss of carbon storage (Greenpeace, 2008). However, the European forests are increasing in size each year, much due to regulations that secures sustainable development (CEPI, 2008). The main problems rest in the part of world that does not have a good structure in place for sustainable forest management.

Figure 4.a: Production of paper and board in CEPI countries, quarterly trend 2000 - 2010

Source: CEPI Preliminary Statistics, 2010

The paper industry in Europe, North-America and Japan was strongly affected by the financial downturn in 2008 – 2009 (CEPI Annual Statistics, 2009), and the European paper industry shrank 15 per cent during this period (CEPI Sustainability Report, 2009, p. 14). At the same time they are meeting increased competition from paper producers in emerging countries, which are experiencing a rapid growth. Brazil has had a stable production level over the last few years, while China reported a 12 per cent production increase in 2008 – 2009 while the Western world stumbled (CEPI Annual Statistics, 2009). In 2010 the CEPI countries again reported production growth; however the level is still below pre-crisis level as Figure 4a shows.

Reduction of paper usage has become a focus for several environmental groups' campaigns, as a measure for saving the environment. However the paper industry itself claims that paper is a sustainable product, because it is produced by using a renewable raw material, as well as using recycled material (CEPI, 2008). Also, an argument from the European paper industry is that because the European forests are to a large extent managed sustainably, as a great share of their forests have some sort of approved certification, the forest area is not reduced but on the contrary increased over the last years. Another fact provided by CEPI (2008) is that the CO_2 storage continues to the finished product, and hence they still have a positive effect on the climate. Nevertheless consumers seem to be taking the message from the environmental groups seriously and many companies try to become "paperless". This alone is not likely to be the explanation for the recent downturn in the demand for paper. A combination of a larger environmental focus, as well as the continuous development of new technology that is making it easier to read information straight off the web, is contributing to the decreasing demand.

Paper producers have to a large extent seen the importance and the positive effects for their business by being environmentally friendly, and many of them therefore strives to buy from forests that have obtained some forest certification, as well as taking internally measures to become more sustainable. Paper producers in Europe prefer certified wood from either PEFC or FSC. This does not imply that the wood they use is 100 per cent certified, as it is not required. In Norway the forests are mainly PEFC-certified because this satisfies government regulations as well as their customer's demands. Since the general share of certified wood in the world is low, the pressure on achieving higher standards than PEFC for businesses in the paper industry is not in focus, and hence those having some sort of certification get their wood sold.

Catalogues is an important marketing tool for businesses, and can almost be labeled as an industry of its own. The catalogue business in general has during the last 5-6 years been under close scrutiny by environmental organizations. As hundreds of millions of catalogues is distributed worldwide every year, keeping an environmental focus on these products is also important. ForestEthics, a group that are focusing on protecting endangered forests and its inhabitants, had a two-year campaign against Victoria Secret, whom they could prove distributed one million catalogues a day without any environmental standards (Merrick, 2006). One of the main issues with Victoria Secret was that their catalogues were made with pulp from endangered forests in Canada, which threatened the wildlife there. After a long period of campaigning by ForestEthics got Victoria Secret to make changes in its catalogue design, and most importantly developed a paper procurement policy which among other state that they will give preferences to products endorsed under FSC. This was made after discussions with ForestEthics, and they have since then been close partners. This partnership has made Limited Brands, the owners of Victoria Secret, more aware of its environmental impact, and is working towards encouraging other catalogue publishers to put in place measures that will make them greener (Limited Brands, 2011).

Catalogues is normally a part of the promotion process for a company, it is usually not in focus like their main activities, and is therefore easy to forget when looking at a company's environmental profile. For IKEA their annual catalogue is the most important element in their global marketing strategy and in 2010 197 million copies were printed in 29 languages and 61 editions (IKEA Sustainability Report, 2010, p. 3). The Swedish furniture giant has since they started publishing a sustainability report shown a focus on their catalogue suppliers, and has both general and industry specific requirements that apply to them as well.

5. The Non-Integrated Supply Chain

5.1 NORTØMMER

NORTØMMER has been present in the timber market for 50 years, first as a timber department in NORSKOG, and later as its own company from 1998 (NORTØMMER, 2011). Presently NORTØMMER is a daughter company of NORSKOG, which is a member organization for forest owners. Their members represent about 7 million decare productive forests (NORSKOG, 2011). NORSKOG assists their members with maintaining property rights, maintaining the rights to control the resources on their forest properties, and works to continue economic development related to the activities initiated by their members.

Forest owners can sell their timber through NORTØMMER, which helps them with coordination of transportation and the fulfillment of certifications and requirements. Membership is not required in order to sell through NORTØMMER, so they sell for both members and non-members. Annually they sell more than 900 000 m^3 timber all over Norway (NORTØMMER, 2011). In 2010 the total sales of timber from Norwegian forest owners reached 8.2 million m^3 according to numbers from Statistisk sentralbyrå (2011*b*). NORTØMMER's customers are mainly Norwegian, but they sell to some Swedish and German customers as well (Bergsaker, 2011).

NORTØMMER is certified after ISO 14001 and the Living Forest Standard for a sustainable forest, meaning that both NORTØMMER as a group as well as their members of forest owners is certified. Members of NORTØMMER are offered PEFC certification free of charge if they sell all of its timber through NORTØMMER. Some chose to take this offer, while others prefer to cover the certification themselves so they can hold the option of selling through other channels open.

Even though PEFC is the main certification scheme for NORTØMMER and its members, they also offer their members to become FSC-certified, as this will expand the market for the firm because some customers demand it. However, the demand for FSC-certified timber is fluctuating and not very high, and hence few forest owners see the need to get FSC-certified.

5.2 Norske Skog

Norske Skog is a Norwegian paper producer which was established in the 1960s by the forest owners as they wanted a company that ensured a good payment for their timber. In the late 1990's their international expansion started. According to Norske Skog (2011*a*) they are today one of the world's leading producers of newsprint and magazine paper. Norske Skog Saugbrugs, a production unit in Halden, Norway, is one of the world's largest producers of uncoated magazine paper (Norske Skog, 2011*b*). This type of paper is the type used in the IKEA catalogue, and Saugbrugs is one of IKEA's 39 suppliers of magazine paper (Norske Skog, 2011*c*).

Norske Skog has in the last years published an annual sustainability report to highlight which actions they are taking in order to become a more sustainable business. They have been awarded for their reporting of greenhouse gas emissions and their openness about climate challenges facing the company. Norske Skog is also a part of the Global Reporting Initiative (GRI), and claims that their reporting practice is almost wholly in line with the GRI's principles (Norske Skog, 2011*d*). In 2003 they also signed the UN Global Compact which commits them to comply with the ten principle concerning sustainability.

The company claims to be a pioneer when it comes to setting a global standard for social responsibility, as they have adopted and committed to several international agreements and principles. Norske Skog says that they in addition to following relevant legislation and statutory requirements, try to do more; "In most cases we set stricter standards for our activities than national or local governments" (Norske Skog, 2011*e*).

According to their Annual Report in 2010 (p. 50), all of Norske Skog's business units are ISO 14001 certified. In their environmental policy an important point is that they are expecting the same environmental standards from their partners in the supply chain. Norske Skog recognizes both PEFC-certification and FSC-certification, and uses the Chain of Custody (CoC) system to trace the origin of their sourced wood and make sure it is from a sustainable managed forest. Their goal is that 100 per cent of their fibres used in production are certified. In 2010 76 per cent (Norske Skog Annual Report, 2010, p. 14) of Norske Skog's fresh fibre material comes from certified forests, which is an increase of twelve per cent 2008 (Norske Skog Annual Report, 2009, p. 99). Norske Skog also uses recycled paper in production at many of their mills, and in 2010 recycled fibre made up 34 per cent of raw materials used in their products (Norske Skog Annual Report, 2010, p. 26).

They have a focus on continuously improving their environmental performance, and in 2009 they invested NOK 223 million (approximately EUR 28.5 million[1]) in environmental investments (Norske Skog Annual Report, 2009, p. 30). However, in 2010 the investments only amounted to NOK 59 million (approximately EUR 7.5 million[1]) as a consequence of the economic downturn (Norske Skog Annual Report, 2010, p. 34). Investments made in 2009 were mostly projects meant to find ways to improve the contents in their fibers and fillers, as well as cleaning water and energy saving measures. The following year resulted smaller investments, mostly related to energy saving and the reduction of emissions to the receiving water.

Norske Skog is measuring and reporting their greenhouse gas emissions by using the framework created by CEPI. Their main reduction strategies are to reduce energy consumption, change the source of energy and to optimize the use of process chemicals and transport (Norske Skog Annual Report 2010, p. 28). Their long-term goal is to reduce greenhouse gas emissions with 25 per cent compared to their 2006 level. By 2010 they had managed to reduce their greenhouse gas levels by 9.5 per cent. Their reduction targets are based only on emissions from scope one and two, and on data from their 13 wholly owned mills. To keep track of their emissions, Norske Skog is measuring their own carbon footprint, but only for the entire organization. They do not have easily accessible information about product's carbon footprint. Their carbon footprint covers (Norske Skog Annual Report, 2010, p.28):

- *Purchased electricity and heat*
- *Producing other raw materials and fuels*
- *Forest and recycling operations*
- *Transport- excluding transport to final customer which is calculated on a case by case basis*
- *Carbon stored in forest products (biogenic carbon), is reported separately*

5.3 IKEA

IKEA started as a small business in a village in Sweden, established by Ingvar Kamprad. Since 1943 IKEA has expanded to be one of the most known furniture concepts worldwide. The IKEA business concept is to offer low cost furniture that makes life easier for its customers. They have warehouses in 41 countries and a turnover of more than EUR 23.1 billion annually (IKEA, 2011*a*). Every year, IKEA distributes their catalogue to customers

[1] 24.05.2011: EUR 1 = NOK 7.84

worldwide. In 2010 the numbers of copies distributed of the IKEA catalogue amounted 197 million (IKEA, 2011*b*).

IKEA has set as a long-term goal that sustainability must be an integrated part of their business, and they claim to be working continuously with environmental issues that will make them a more sustainable company. The company acknowledges the UN Global Compact's ten principles, and through their partnership in the Global Social Compliance Program they are exploring the possibility to develop global supply chain standards, which will make it easier for the supply chain to become more efficient.

In 2000 IKEA introduced their own code of conduct called the "IWAY", which is a set of requirements that IKEA has for their suppliers when it comes to addressing environmental issues as well as social and working conditions. The standard consists of one general part, and different industry specific parts. IWAY requires their suppliers to act in line with national laws and regulations. According to IKEA they select suppliers who fulfill their start-up requirements, and cooperate with them to make their business more sustainable.

IKEA is cooperating with the environmental organization WWF with a climate project which purpose is to make the entire business supply chain greener. Together they are working on environmental solutions that will benefit the environment and reduce greenhouse gas emissions. In order to know which processes that are creating most emissions, they are also measuring their carbon footprint. IKEA is following the tool provided by the Greenhouse Gas Protocol, and includes all three scopes as advised (IKEA Sustainability Report, 2010, p. 74). This implies that they are also including customer travelling to and from the IKEA stores in their emission calculations. The emission measure is still inaccurate, but it provides a good picture of the emissions the company is responsible for. Their current calculations show that scope three is the largest emission source, a scope often excluded when companies measure their carbon footprint.

6. The Integrated Supply Chain

6.1 UPM

UPM was established in 1995 after a merger between Kymmene Corporation and Repola Ltd and its subsidiary United Paper Mills Ltd. The company has a long tradition in the Finnish forest industry. Already in the early 1870's the group started their first pulp-, paper- and sawmills operations (UPM, 2011*a*). Today UPM comprises of six business areas: Energy, Pulp, Forest and Timber, Paper, Label and Plywood (UPM Annual Report, 2010, p. 15). UPM calls themselves The Biofore Company. Biofore represent the integration of bio and forest industries (UPM Biofore, 2011). This is a new industry category which UPM has created, and their aim is to be the front-runner.

In 2010, UPM was the world's largest producer of graphic papers, with a production capacity of 10.4 million tonnes (UPM Annual Report, 2010, p. 35) and the second largest biomass-based electricity generator in Europe supporting the efforts to reach EU climate targets (UPM Annual Report, 2010, p. 10). In addition, UPM aims to become an active player in the CO_2 emission-free energy market and a significant producer of second-generation biodiesel and of renewable and high quality biofuels in the next few years. To their pulp customers, UPM offers environmental product declarations (UPM Annual Report, 2010, p. 26). UPM works actively with their suppliers to further increase transparency in the supply chain and with this tries to maximize their share of certified fibres (UPM Annual Report, 2010, p. 29-32).

UPM sets its own environmental targets and their responsibility principles are based on operational targets that create the framework of responsibility for all company operations. However, in addition to this framework, UPM also follows EU's new Energy 2020 strategy closely. During 2010, UPM's environmental investment totaled EUR 18 million, an increase of EUR 4 million from 2009. By 2020, UPM aims to have 80 per cent of their fibres either PEFC or FSC-certified. They nearly reached this goal in 2010 with 78 per cent certified fibres (UPM Annual Report, 2010, p. 60). According to UPM's Annual Report (2010, p. 40), UPM has gained a total of EUR 55 million from all of its energy savings activities and a 7 per cent reduction in CO_2 emissions the past two years.

UPM continuously aims to reduce environmental impacts over the whole lifecycle of its products. To reach this goal, UPM uses recycled fibres in their production and in 2010 30 per cent of their fibre material came from recycled fibres (UPM Annual Report, 2010, p. 25).

They also focus strongly on their carbon footprint and aims to reduce their fossil CO_2 with 15 per cent by 2020 with 2008 as a base year (UPM Annual Report, 2010, p. 53). Today 70 per cent of UPM's generation capacity is CO_2 emission-free and their products are mainly produced using renewable energy and sourced from responsibly managed forests (UPM, 2011*b*).

7. Green Supply Chain Management Case Studies

Green supply chain management is about making the supply chain greener. We have in the previous chapters presented some facts about supply chains and environmental policies as well as greenhouse gas emissions and its causes, how to measure and most importantly how to reduce it. The brief description of the industry and the companies we are focusing on is also of importance to know how the market and the industry look today, and to give you an understanding of the two supply chains that we are studying. In this chapter we present two case studies: One non-integrated supply chain and one integrated supply chain. The purpose of these case studies is to describe what is done in the two different supply chains that make the entire system greener. By greener we are thinking about environmental measures that reduce the greenhouse gas emissions.

7.1 Case Study of the Non-Integrated Supply Chain

The non-integrated supply chain consists of three different companies. NORTØMMER is the smallest, and a supplier of Norske Skog. When studying the supply chain our impression is that NORTØMMER mostly do what is required by them from the government and their buyers, without necessarily trying to set an agenda for the rest of the supply chain. Norske Skog and IKEA on the other hand, have a more visible environmental strategy. They are also more open about their numbers, at least to a certain degree. By studying this non-integrated supply chain we note that both Norske Skog and IKEA are trying to become greener, but use different approaches. A common factor is that they both have set some environmental targets they want to achieve, but they use different measures to reach them, and are also part of different initiatives with different focus.

7.1.1 Green Design

Thinking green when designing can make a big difference for the environmental profile of the product and company. Even so green design does not appear as a major focus area for the participants in the industry. There are several aspects product developers should have in mind when designing new products, like materials used, size and packaging.

IKEA are using the “E-wheel” to understand and evaluate the environmental impact of their products. The wheel consists of several checkpoints which are divided into five phases: raw material, manufacturing, distribution, use and end of life.

Figure 7.a: The E-Wheel

Source: IKEA, 2011*c*

In the non-integrated supply chain that we are studying, the end-product is the IKEA catalogue; a product where wood is the main raw material that becomes the magazine paper in the catalogue. Its design influences the environmental impact of the supply chain as a whole makes. When producing 197 million copies a year of the catalogue, improvements in its design can potentially make a big change. Please note that there is no public information on whether IKEA also applies the e-wheel on their catalogue.

IKEA realized that by improving its design they could improve their greenness, and in 2009 they published a redesigned version of the catalogue which generated less greenhouse gas emissions than the former version. One of the changes made were a reduction of the catalogue size so that less paper is needed, and thus less energy needed for production. By having smaller catalogues, they can fit more catalogues per transportation unit, and hence reduce greenhouse gas emission from transportation as well (IKEA, 2011*c*).

The catalogue was also the first major color publication in the world that is printed on totally chlorine free paper (TCF) (IKEA Sustainability Report 2010, p. 50). As new innovations in the pulp and paper industry have evolved the focus has shifted to avoid using elementary chlorine. Today's version of the catalogue is printed on a mix of TCF and elementary chlorine free paper.

7.1.2 Green Packaging

It is not only the product that is produced and sold that leaves a carbon footprint, but also the packaging of it. By studying your own waste container, you easy get an impression of how much unnecessary packaging you get from the products consumed every day. Although environmental organizations seem to speak up about the uncritical use of packaging once in a while, their critics does not seem to have reached the paper business. Only IKEA has a focus

on it, although this mainly concerns their furniture business. How much packaging is needed for paper is therefore not easy to estimate, but it is reasonable to believe that they do cover it with something before transportation.

Packaging is a large part of the operational life cycle, and because of that there is several ways of making the supply chain greener by doing changes to the packaging process. This often goes hand in hand with product design, as designing products when having efficient packaging in mind can make improvements that will reduce the environmental impact of the product throughout the supply chain. Also, by using environmentally friendly material for packaging one can develop greener solutions.

At IKEA product developers have to keep in mind product packaging when designing their products. IKEA packs its furniture in recyclable packaging, however their public information does not say which packaging is used for the catalogues.

Another part of packaging is labeling, and in this case we are specifically focusing on environmental labels. These function as a visible proof for the customers, saying which environmental requirements the products fulfill. All of NORTØMMER's products are delivered with papers stating which certifications the wood satisfies. As for Norske Skog, there is no information concerning labeling of their products according to public information available, such as their website and annual reports.

The IKEA products do not have any environmental labels; they are only labeled with the IKEA logo. IKEA has received criticism concerning the absence of environmental labels by environmental organizations. However, IKEA means that their logo should be proof enough of their products' quality and that they have been produced sustainably (Gilje, 2009).

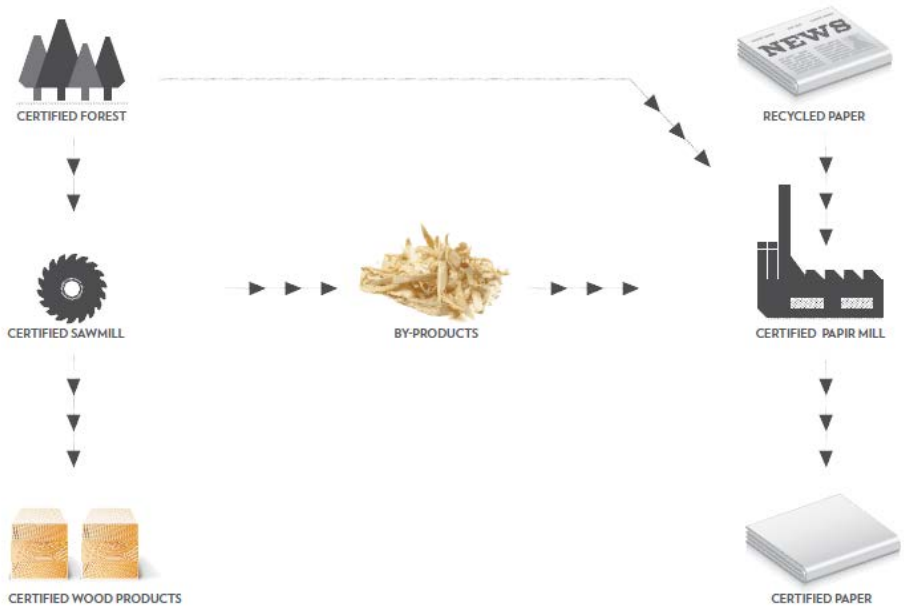
7.1.3 Green Procurement

As goods and raw materials are flowing through a supply chain, it is of importance for the entire supply chain's environmental profile which raw materials and processes the other units have used. When purchasing, many firms have requirements that need to be fulfilled by their suppliers in order for a trade to take place. If the downstream company of a supply chain sets some demands for their purchasing, the upstream companies need to follow them if they want to sell their goods to this company.

In a paper supply chain where the main raw material is wood, green procurement concerns predominantly forest management and production facilities. For a forest supply chain to be a

part of the climate change solution the forest must be managed sustainably. Both Norske Skog and IKEA have stated their requirements and preferences when it comes to forest management. For a product to be certified, the entire supply chain must be certified, from the forest, to the mills and the end product. Forest managers have systems for Sustainable Forest Management (SFM), while forest products traders rely on Chain of Custody certification so that they can trace the products origins (Norske Skog, 2011*f*).

Figure 7.b: Certification of Fresh Fibre through the Supply Chain



Source: Norske Skog Annual Report, 2010, p. 25

Both IKEA and Norske Skog require that their suppliers of wood are managing their forests sustainably. While Norske Skog recognizes PEFC, FSC and ISO 14001 standards, in addition to other declarations that prove that the forest is managed in accordance with national environmental laws and regulations, IKEA has stricter requirements. They only recognize FSC, including the Forest Management and Chain of Custody standards, as approved forest certification. However, even though they only recognize FSC, they still buy wood that does not fulfill these requirements. The share of certified fresh fibre that Norske Skog sources is 76 per cent in 2010 (Norske Skog Annual Report, 2010, p. 14), while of IKEA's catalogue suppliers only 21 per cent is CoC-certified with FSC (IKEA Sustainability Report, 2010, p. 21).

Since it do not exist a Norwegian FSC-certification at the present, the FSC certification is not very widespread in Norway yet. According to Erling Bergsaker (2011) in NORSKOG the

forest owners do as the market demand and today only two out of a few hundred Norwegian forest owners that sells through NORTØMMER is FSC-certified, while all of their members are PEFC-certified. It seems therefore that the forest owners have little problem selling timber that is only PEFC certified.

As Norske Skog does not own a significant amount of forest themselves, they are depending on the choices that forest owners make. Their global wood purchasing policy is to ensure the procurement of only sustainable managed forests. Wood represents 51 per cent of the total raw material that is consumed by Norske Skog (Norske Skog Annual Report, 2010, p. 26), and the IKEA catalogue is produced with paper coming from the production mill, Saugbrugs. Traceability of the raw materials and its origin is important, and their CoC-system ensures that they only buy wood from sustainably managed forests. Saugbrugs is CoC-certified after the PEFC-standard for their SC uncoated paper (PEFC, 2011*a*).

The IKEA IWAY states some start-up requirements before one can become their supplier, both general and industry specific requirements. The basic requirements for their suppliers are not concrete numbers, but for example that there shall be “no severe pollution” from the suppliers business activities and they must “prevent pollution” and “work to reduce energy consumption” (IKEA Sustainability Report 2010, p. 38). Their criteria are vague, but at least they have a focus on it and state that their aim is to improve the greenness of their supply chain. They check their suppliers annually by sending them a questionnaire that they fill out and send back (IKEA Sustainability Report, 2009, p. 25). From 2010, IKEA decided to conduct systematic audits of the IKEA Catalogue Suppliers in addition to the questionnaires (IKEA Sustainability Report, 2010, p. 50).

IKEA has also industry-specific requirements, and states special requirements for the different types of suppliers, like furniture suppliers, food suppliers and catalogue suppliers. As mentioned above, IKEA introduced a new format for their catalogue in 2009, and with this some new specific requirements for supplier documentation followed. From now on catalogue suppliers have to document water usage as well as energy consumption, including share of renewable energy as IKEA requires that a minimum of 50 per cent of energy must come from renewable sources (IKEA Sustainability Report, 2009, p. 25-26).

Other requirements described in the Sustainability Report 2009 for the paper suppliers of the IKEA catalogue is that: no elementary chlorine may be used in the bleaching process, all transportation of fibre pulp and paper must be documented and specific limits on emission to

air and water. With these measures taken, IKEA claims that its catalogue's environmental impact has been reduced (IKEA, 2011*c*). Table 7.a gives a summary of some of IKEA's key indicators of environmental performance for its 39 magazine catalogue suppliers. IKEA has managed to increase their performance in four out of five areas. However, the share of IWAY certified paper suppliers have decreased since the peak of 94 per cent in 2009. According to IKEA this is due to a new supplier that has not yet been certified, and they claim that measures have been put in place to get the supplier certified within the end of 2011. The share of FSC-certified suppliers is even less than IWAY-approved paper suppliers. Even though IKEA states a clear preference for FSC, the table shows that only one fifth of their fibres are FSC certified, however it is a great improvement from the five per cent until 2009. IKEA's IWAY standard is their map for becoming a more sustainable business. They have a lot of preferences, but as the numbers indicate they are still behind on their targets. The recent increase of their share of certified wood is a consequence of more available certified wood over the last few years, as well as that they are more actively supporting certification processes in some of their main sourcing areas, such as Russia and China (IKEA Sustainability Report 2010, p. 59).

Table 7.a: Catalogue suppliers

Key Performance Indicators Catalogue Suppliers, %				
	2007	2008	2009	2010
IKEA Catalogue Sustainability Requirements, approved suppliers	70	71	73	86
Industry-specific requirements, approved suppliers	54	53	50	65
Certified paper suppliers	82	61	94	89
FSC-certified CoC fibres	5	5	19	21

Source: IKEA Sustainability Report, 2010

7.1.4 Green Production

In the production process large improvements may be made seen from an environmental perspective and this opens for several ways to make the supply chain greener. Norske Skog claims to be working continuously with improvements in their production process that will make them more environmentally friendly (Norske Skog Annual Report 2009, p. 103). They have introduced their own Environmental-index (E-index) to more easily follow up the environmental improvements of the company. Norske Skog sets annual targets for the

different parameters of the E-index, and calculates the total E-index score for the entire company. In 2010 their E-index score was 1.14, which was below their target for 2010 of 1.09 (Norske Skog Annual Report 2009, p. 30). An index value of 1.0 or less indicates that the mill have an environmental standard which satisfies the performance attainable with the best available technology or best practice for that mill.

IKEA can by changing product design make the production process more environmentally friendly. This is what they have done with their catalogue, as the new format reduced both energy and water usage in the production of each catalogue.

There is a connection between efficiency in the production process and the degree of environmentally friendly profile. Norske Skog for instance, had an economic downturn in 2009 which led to suboptimal production and hence they used more energy per tonne, and consumed more water than previously. Water consumption is of importance, as human consumption of water for production may lead to water shortages and pollution (Water Footprint, 2011). Below we will take a closer look at energy consumption, usage of water and waste handling in the non-integrated supply chain's paper production process.

Energy

Paper production is a very energy consuming process, and most of the greenhouse gas emission comes from the energy they purchase and produce to operate their mills. Norske Skog states in their annual report that they are seeking to reduce their energy consumption to make it more environmentally friendly. They consume energy for two purposes: to drive production processes which separate, process and transport fibres and water, and to provide process heat and dry paper. It is the process where they convert woodchips into fibre that demands the most electrical energy, also called the thermo-mechanical pulping (TMP) process. Norske Skog provides numbers for the share of different energy sources that they use. Approximately half of the energy used is electrical energy, while the remaining sources are fossil fuel (16 %), biofuel (14 %), heat recovery from the TMP-process (9 %) and other sources purchased from external parties, such as geothermal energy and steam (7 %) (Norske Skog Annual Report, 2010, p. 27). Thermal energy is in most cases generated within the mill for example by recovering heat from the TMP, effluent treatment processes or the combustions of mill residues to mention some.

One of the parameters in the E-index is total energy consumption. It shows that despite a focus on energy and efficiency, their energy consumption has increased from 11.3 GJ/tonne in

2007 to 12.56 GJ/tonne in 2010 (Norske Skog Annual Report 2010, p. 30). This increase is explained by the sale of the Chinese mill which only used recycled paper, as recycled paper consume less energy, (Norske Skog Annual Report 2009, p. 100), as well as an economic downturn in 2009 causing suboptimal production.

At Norske Skog's mill Saugbrugs, they are only using fresh fibre for production and hence use more energy for production than what is possible if one uses some share of recycled fibre. Saugbrugs uses the paper machine PM 6 in the production of magazine paper, which is a modern paper machine made more energy efficient than their previous machine (Anttilainen & Salenius, 2007), however we have not been able to extract exact data that tells us the amount of energy that Saugbrugs uses for the paper they supply IKEA. What is known is that for one copy of the 2010 edition of the IKEA catalogue they used 2.96 kWh per catalogue, which is an improvement from the 3.04 kWh used for the 2009 catalogue (IKEA Sustainability Report 2010, p. 51).

IKEA has set requirements for their suppliers to their catalogue which also concerns their energy usage. This is however only concerning type of energy, not the amount although they specify in their industry requirements that use of energy must be documented and energy reduction targets set.

Water

In the pulp and paper production process water is used for moving fibre through the system. About 92 per cent of the water Norske Skog uses comes from surface water, and is used for cooling down machines and equipment. Eight per cent of the water comes from ground water, and only a small part comes from municipal water (Norske Skog Annual Report 2009, p. 104). Water also enters the production process through purchased raw materials as fibre based raw materials contain water. Norske Skog says in their annual reports that they are not really consuming most of the water they use, just using it and returning it to the water cycle after treatment that cleans the water according to local regulations. When the water is discharged, it is important that the water has gone through treatment processes that removes solid particles and dissolve organic material before it is let back into nature. Usually the water is used several times before going through treatment and returned to the water cycle. By this Norske Skog means that they are not "stealing" important water resources from areas where it is a general lack of water.

As water is a scarce and valuable resource, IKEA requires that all suppliers document their water usage through the annual questionnaire. Over the last few years, IKEA has obtained improvements when it comes to water consumption per copy; in 2006 the amount of water per copy was 18.12 liter, while it in 2010 was 14.26 liter (IKEA Sustainability Report 2009, p. 25; IKEA Sustainability Report 2010, p. 51). Much of the improvement came as a consequence of the new format IKEA introduced, which was designed to be less water consuming. IKEA is also reporting emissions to wastewater per catalogue, and has achieved improvements the last few years as the number has been reduced.

Waste

Paper production generates a lot of waste, and if the resources put into the process are not used efficiently the waste released from the production process is larger than what is favorable. It is possible to design the production processes so that they minimize waste, and hence is more environmentally friendly.

One of Norske Skog's measures on its E-index is waste to landfill, which they are trying to reduce. The majority of solid waste occurs from the processing of fibre inputs and from the treatment of effluents (Norske Skog Annual Report 2010, p. 32), and most of their mills have machines that can produce thermal energy from the solid residues. Despite the focus, the waste to landfill from production processes increased from 20.4 kg/tonne in 2009 to 21.4 kg/tonne in 2010. It is also of interest to note that in 2007 their waste to landfill was only 18.5 kg/tonne (Norske Skog Annual Report 2009, p. 103). Norske Skog explains their increase by a higher production volume, and is targeting having an emission per tonne produced at 19.4 kg/tonne in 2011. Reusing the residues from the production process is an important measure when trying to reduce total emissions. Norske Skog utilizes numerous ways of reusing residues from the production processes, and in 2010 72 per cent of the waste was used as biofuel (Norske Skog Annual Report 2010, p. 32). Other ways of reusing the residues is by making bricks and concrete from the ash residues and reusing it in agricultural processes. However, part of the waste also ends up as landfill.

IKEA states in their Sustainability Report 2010 that they are working on reducing waste throughout the supply chain. Their long-term goal for 2015 is that none of their waste shall go to landfills. This goal seems to be mainly focused on their furniture business, and the furniture suppliers. However, one of the environmental benefits of the new catalogue format is that it is supposed to reduce paper waste, as each catalogue consists of less paper.

7.1.5 Green Logistics

There are different ways to reduce greenhouse gas emissions through logistics. First of all, by travelling fewer kilometers one also lowers the greenhouse gas emissions and in most cases one also achieves a reduction in fuel costs. One can also choose more environmental friendly transportation modes such as train instead of trucks, since trains use less energy to move goods and are therefore a more energy-efficient, environmentally-friendly transportation solution. Another option is to use more environmentally friendly trucks which will let out less greenhouse gas emissions. Lastly, by ensuring that capacity is fully utilized and by balancing outbound and inbound deliveries one can reduce total emissions.

NORTØMMER decides which transportation mode to use depending on the cheapest alternative instead of the most environmentally friendly. If the cheapest transportation mode is the more environmentally friendly option, then it is more a coincident than a conscious choice. Reloading the lumber from one transportation mode to another is quite expensive and NORTØMMER therefore always choose to use trucks if the distance is less than 100 kilometers (Bergsaker, 2011). They also use trains and boats for transportation of the lumber and has expressed interest in reopening more railways so they can be used for transportation. NORTØMMER sells their lumber to the customer who pays the most. As a result of this, the lumber does not necessarily go to the closest customer and consequently the greenhouse gas emissions increases with longer distances. When the lumber is sold, it is either NORTØMMER or the buying customer who organizes the transportation (Bergsaker, 2011).

Norske Skog transports large amounts of raw materials (timber, chips, recovered paper, chemicals and energy) to their mills and 4 million tonnes (Norske Skog Annual Report, 2010, p. 34) of paper are transported to the customers. To minimize greenhouse gas emissions, Norske Skog is trying to source their raw material locally as well as trying to use transport suppliers that employ the same environmental standards as them. The suppliers must also comply with local rules and regulations. Most of Norske Skog's products are sold to international customers. The distances are therefore often long, and the choice of transportation mode is consequently of great economic and environmental importance. Local wood sourcing is therefore one important factor for reducing the environmental impacts of transportation.

Trucks are the dominant transportation mode in Norske Skog. For their inwards transportation in 2010, trucks accounted for more than 83 per cent and respectively 50 per cent of their

transport of finished products to their customers. Ship and train deliveries accounted for seven and ten per cent for inwards transportation and 30 and 20 per cent of transportation of finished products. From 2008, there was an increase in Europe in the use of ships and trucks and corresponding reductions in rail transportation (Norske Skog Annual Report 2010, p. 34).

Table 7.b: Transportation Modes used by Norske Skog

Transportation of Raw Materials				
	2007	2008	2009	2010
Road	82 %	77 %	83 %	83 %
Ocean	8 %	11 %	8 %	7 %
Rail	10 %	12 %	9 %	10 %

Transportation of Finished Products				
	2007	2008	2009	2010
Road	49 %	45 %	45 %	50 %
Ocean	23 %	30 %	32 %	30 %
Rail	29 %	25 %	23 %	20 %

Source: Norske Skog Annual Report, 2007-2010

Norske Skog uses trucks to transport their finished products from Saugbrugs to their harbor in the city of Halden where the products are sent with ships to the customers. In 2011, more than 20 000 trucks will transport paper through the city center of Halden (Prang, 2011). Due to the large number of trucks, Friends of the Earth Norway (Naturvernforbundet) in Østfold says that they believe that Norske Skog's environmental profile is not legitimate (Prang, 2011). Many politicians have also expressed that they think that Norske Skog should build a railway between Saugbrugs and the harbor. However, it seems like Norske Skog today has no plans of building any railways. According to Olle Axxell, the director[2] at Saugbrugs, Norske Skog has simply not the sufficient funding for an investment like this (Prang, 2010).

The environment will benefit by minimizing transportation distances, and it will also decrease transportation costs for the supply chain. Consequently, Norske Skog continually strives to have in place efficient logistics systems which will in return help to reduce transport-related greenhouse gas emissions. This ongoing optimization of their logistics system is done in cooperation with their transport providers (Norske Skog Annual Report, 2010, p. 34). In 2010 Norske Skog's greenhouse gas emissions from internal transportation and mobile sources amounted to 10 000 tonnes CO_2-equivalent (Norske Skog Annual Report, 2010, p. 28) which was a reduction of 2 000 tonnes from 2009 (Norske Skog Annual Report, 2009, p. 101).

As you can see from table 7.c, the direct emission from transportation in 2007 was half compared to 2010 even though Norske Skog transported 2 million tonnes more finished products in 2007. This might be a consequence of Norske Skog's higher share of

[2] Olle Axxell is *direktør* at Norske Skog Saugbrugs.

transportation by trains in 2007. The share of trains used for transportation of finished products has fallen with approximately ten per cent, which is a fairly high percentage.

Table 7.c: Greenhouse Gas Emissions from Transportation

	2008	2007	2009	2010
Finished products transported (in million tonnes)	6	4.8	3.7	4
Direct emissions from transportation and mobile sources: CO_2-equvivalent (tonnes)	5 000	7 000	12 000	10 000

Source: Norske Skog Annual Report, 2007-2010

IKEA uses road, railways and sea to transport their products between suppliers, distribution centers and IKEA stores. According IKEA Sustainability Report (2010, p. 80), IKEA choose rail transportation where possible when this is the more environmentally friendly option. To become a supplier for IKEA, one must achieve a minimum score of 100 points in Europe in the ranking developed under European Retailers Round Table (ERRT). The suppliers must also comply with IKEA's IWAY requirements and other environmental requirements that are included in a transportation section supplement to IWAY. Finally, they must also complete an annual "Environmental Performance Survey" (IKEA Sustainability Report, 2009, p. 27). According to IKEA Sustainability Report (2009, p. 28), 67 per cent of the transport service providers was IWAY approved.

In 2010, 73 per cent of the goods were transported by road, while 16 per cent were transported by ocean, two per cent by railways and nine per cent by combined transportation (IKEA Sustainability Report, 2010, p. 80). As one can see from the table, the share of trucks has increased almost every year from 2007 while the share of ships and train has decreased.

Table 7.d: Transportation Modes used by IKEA

Transportation				
	2007	2008	2009	2010
Road	69 %	69 %	72 %	73 %
Ocean	17 %	18 %	15 %	16 %
Rail	5 %	4 %	3 %	2 %
Combined (including barge)	8 %	9 %	10 %	9 %

Source: IKEA Sustainability Report, 2010, p. 80

In 2010 IKEA's filling rate was 64 per cent for transport from supplier to warehouses and from the warehouses to the stores, the filling rate was 60 per cent (IKEA Sustainability

Report, 2010, p. 80). According to calculations based on current conditions, an increase of the filling rate from 63 per cent to 70 per cent can potentially reduce greenhouse gas emission from transportation with 6.3 per cent (IKEA Sustainability Report, 2009, p. 67). IKEA redesigned their catalogue and made it smaller, and it will therefore be possible to transport more catalogues per unit making transportation more efficient. In other words, by increasing both the filling rate and number of catalogues in each unit, IKEA will also be able to reduce their greenhouse gas emissions from transportation. In 2010 their emissions amounted to 580 000 tonnes (IKEA Sustainability Report, 2010, p. 74), which is only 2000 tonnes less than their emissions in 2009 (IKEA Sustainability Report, 2009, p.65).

IKEA has participated in a project to support transportation service providers making the transit from fossil fuels to alternative fuels with Preem, H&M and Volvo Logistics. The project resulted in a number of Preem fuelling stations opening in Sweden during the summer of 2009. According to IKEA Sustainability Report (2009, p. 66), these stations provided alternative fuel such as Bio30, which contains a 30 per cent blend in of rapeseed oil. Rapeseed oil is made by canola plants that use sunlight and photosynthesis to take carbon dioxide out of the atmosphere. After the rapeseed oil is burned in an engine the same carbon dioxide is returned back to the atmosphere. In other words, rapeseed oil does not increase the carbon dioxide in the atmosphere, and hence does not contribute with increased of greenhouse gas emissions.

7.1.6 Recovering, Reusing and Recycling

By recovering, reusing and recycling materials and waste one will be able to save materials and energy which will benefit the environment. Reusing conserves raw materials and energy which manufacturers otherwise would use in production of new products, while recovering of energy will help reduce greenhouse gas emissions as well as reducing costs. Recycling reduces the amount of material going into landfills and additionally it reduces the pollution that may result from waste disposal.

Paper

Wood is a renewable raw material, and products such as paper are highly recyclable. One of the benefits by switching to post-consumer recycled paper instead of using fresh wood is first of all that it saves trees, and with that input costs as well as reducing waste directed going to landfill. Recovered paper also requires less energy for production of new paper compared to fresh wood because the fibres from recycled paper are more easily separated then those within

wood (Norske Skog Annual Report, 2009, p. 100), resulting in lower greenhouse gas emissions. Kinsella et al (2007) estimated for the Environmental Paper Network that by switching from 100 per cent virgin forest fibres to 100 per cent post-consumer recycled paper one will be able to reduce:

- *Total energy consumption by 44 per cent*
- *Net greenhouse gas emissions by 38 per cent*
- *Wastewater by 50 per cent*
- *Solid waste by 49 per cent*
- *Wood use by 100 per cent*

Some customers want paper based from only recovered fibre. However, this is not possible since paper cannot be recycled indefinitely. It is estimated that fibers can typically be recycled between four and six times before they become too weak and start to disintegrate (Stora Enso Sustainability Report, 2010, p. 29). The recovered fibres which are no longer suitable will be rejected in their mill pulping process and are generally used as a resource for renewable energy, such as bio-energy, which can replace fossil fuels.

Recovered paper is an important fibre source for Norske Skog. In 2008 Norske Skog was one of the world's largest consumers of recovered fibre as raw material for production of publication paper as they used 2.1 million tonnes of recovered fibre (Norske Skog Annual Report, 2008, p. 33). However, after the sale of the operations in South Korea and China, their exposure to the recovered paper market has decreased substantially and in 2010 they had a consumption of 1.5 million tonnes of recovered fibre (Norske Skog Annual Report, 2010, p. 26). Recycled fibre made up 34 per cent of the raw materials in Norske Skog's products in 2010.

According to IWAY, IKEA's catalogue suppliers must agree to contribute to the recycling and reuse of materials and used products (IKEA Sustainability Report, 2008, p. 12). In other words, there is not an explicit requirement that the suppliers *must use* recycling in their production process to become an IKEA catalogue supplier, they only have to contribute. In 2010, only 11 per cent (11.300 tonnes) of the content in the IKEA catalogues was from recycled fibre (IKEA Sustainability Report, 2010, p. 51).

As mentioned above, there is no explicit requirement that the suppliers have to use recovered paper in their production. Even though there is no explicit requirement suppliers will get more

orders the suppliers will get more orders if they invest in working conditions and in the environment, according to IKEA's Sustainability Report (2009, p. 9). This can therefore be a strong incentive for the suppliers to implement recovered paper in their production as well as doing environmental investments.

Norske Skog purchases most of its recovered paper by mills based on local contracts. In addition to these contracts, Norske Skog has established own trading activities for recovered paper which supplies the group's mills to some extent. Most of the purchase of the recovered paper occurs at variable market prices (Norske Skog Annual Report, 2009, p.28). The different type of fibres used in Norske Skog's mills depends upon the availability of raw materials as well as economic considerations (Norske Skog Annual Report, 2010, p. 26). Consequently, Norske Skog does not use recovered paper as a raw material in all of their mills, including Saugbrugs.

IKEA claims to set high requirements for the environment and the quality of the paper for their IKEA catalogue. However, even though Saugbrugs does not use recovered paper in their production, IKEA awarded Norske Skog as the best supplier for their 2010 catalogue (Norske Skog, 2011*c*). They even won over their competitor Stora Enso, which was ranked number one on "The Nordic 200 Carbon Disclosure Leadership Index 2010" by the Carbon Disclosure Project (CDP) (Carbon Disclosure Project Nordic Report, 2010).

Different IKEA stores have also started their own recycling initiatives. IKEA Wembley in the United Kingdom started in 2010 the Catalogue Recycling initiative. This initiative was implemented to get their customers to recycle their old IKEA catalogues in the store. The customers received two vouchers for a vegetarian hotdog or an ice-cream and 1 foot of forest was created by the Woodland Trust on their behalf in exchange for their old catalogue. Altogether with this initiative, they managed to collect over 600 catalogues which is the equivalent of over 600 feet of forest and more than 100 kg recycled paper (Green Hit Squad, 2010).

Bioenergy and biofuel

Most of the low quality wood, such as forest residues from harvesting, bark, organic waste from the production process and rejected recycled fibres from the pulping mill process can be used to produce biofuel or bioenergy. The benefit by using bioenergy or biofuel is that they are neutral in regards to the climate change, as the greenhouse gas emissions that arise from using biofuel or organic residues are deemed to be "carbon neutral". Today they have only

managed to use corn rapeseed and sugar cane as raw materials for biofuel for transportation. This is problematic as it implies utilizing the world food supplies in energy production. By using wood instead, one avoids the conflicting choice between food and energy consumption and is able to have both.

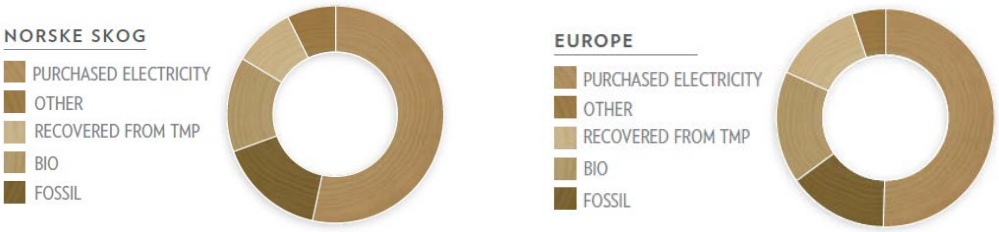
NORSKOG cooperate with Bio Oil AS, a Norwegian company that works for the possibility to have a large-scale production of biofuel based on wood as biomass. Bio Oil's goal is to develop competitive technology for a sustainable and eco-friendly production of biofuel and biochemical, using wood as biomass (Bio Oil AS, 2011).

In 2008 Norske Skog established the company Xynergo AS in a joint venture with the Norwegian Forest Owners' Association (Norske Skog Annual Report, 2009, p. 27). Xynergo AS aimed to produce sustainable and competitive biofuels for transportation and stationary applications utilizing wood as biomass (Xynergo, 2010*a*). However, in a press release in 2010, Norske Skog announced that they would no longer invest more capital in Xynergo AS (Ødegården, 2010) and the project ended in November 2010 due to lack of investments (Xynergo, 2010*b*).

Thermal energy

A large amount of the thermal energy at Norske Skog is generated within their mills. As mentioned under 7.1.4 Green Production, the thermal energy is recovered heat from the thermo-mechanical pulping (TMP) or effluent treatment process, combustion of mill residues, biofuel, oil, gas or coal. On-site produced energy is mainly used to dry paper on the production line and Norske Skog can reuse energy several times through heat recovery systems. In 2010, nine per cent of Norske Skog's energy consumption came from energy recovered from the TMP process, and in Europe this share is even higher (Norske Skog Annual Report, 2010, p. 27). Compared to 2009, energy recovered from the TMP process decreased from ten per cent, however this is a relatively little change.

Figure 7.c: Energy Sources used by Norske Skog



Source: Norske Skog Annual Report, 2010, p. 27

Water

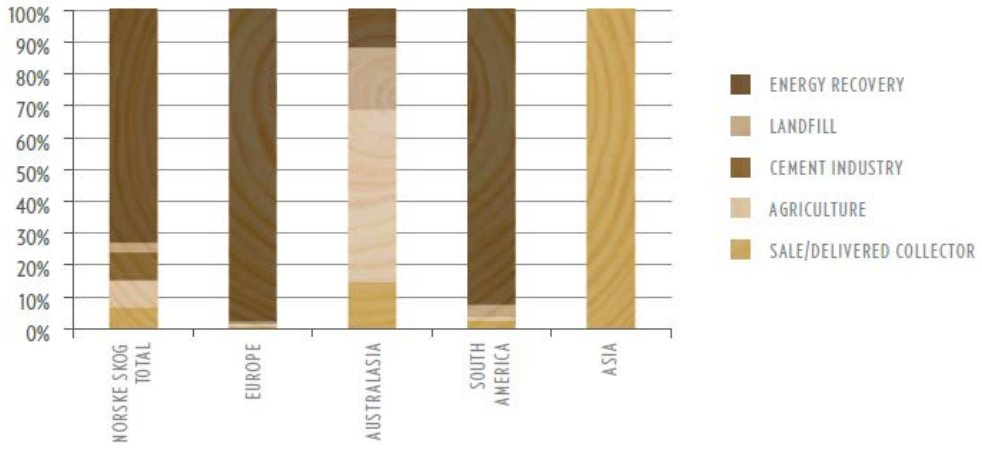
As mentioned under 7.1.4 Green Production, Norske Skog says that they are mostly just using the water and then returning it back to the water cycle after treatment which cleans the water according to local regulations. In 2010, 96 per cent of the water entering their mills was returned to rivers and lakes after treatment. This leaves only four per cent which is either returned to the atmosphere as water vapour, retained in the products or used for irrigation of forest plantations or agricultural areas (Norske Skog Annual Report, 2010, p. 31).

According to IKEAs Sustainability Report (2010), IKEA tries to recycle and reuse water. However, their main focus is on reduction of water use. IKEA reports amounts of used water but they do not report how much water they recycle and reuse.

Waste

The pulp and paper industry generates millions of tonnes of waste from their production of which 70 per cent originate from the production of deinked recycled paper (Monte et al, 2008). The waste generated varies in composition and consist of rejects, different types of sludge and ashes. Due to legislations and increased taxes in Europe, the industry tries to eliminate landfills as a final destination. The industry is therefore trying to reuse and recycle more of its waste, and energy recovery is becoming the main waste recovery method.

Figure 7.d: Disposal of Mill Waste in 2010, Norske Skog



Source: Norske Skog Annual Report, 2010, p. 33

Norske Skog dispose of or recycle their hazardous waste in accordance with national regulations, generally through government authorized collection systems. According to Norske Skog's Annual Report (2009, p. 106) 92 per cent of their mill waste was reused or recycled in 2009. In Europe this figure was even higher. In 2010, Norske Skog managed to

increase the reuse and recycle rate adding up to approximately 95 per cent in total and close to 100 per cent their business units in Europe (Norske Skog Annual Report, 2010, p. 32).

IKEA tries to recycle, reclaim or use as much as possible of their waste in energy production. These shares are already quite high (see table 7.e), however IKEA wants to improve them further and their goal is to have zero waste going to landfills by 2015.

Table 7.e: Disposal of Mill Waste, IKEA

	FY07	FY08	FY09	FY10	Goal FY15
Waste recycled, reclaimed or used in energy production, %					
Distribution	76	90	90	91	100
Swedwood	68	72	74	95	100
Swedspan	–	–	–	86	100
Stores	84	85	86	84	100

Source: IKEA Sustainability Report 2010, p. 71

7.2 Case Study of the Integrated Supply Chain

The integrated supply chain we are focusing on in this case study is UPM, the Biofore Company. They are a large and important player in the international paper industry, and in 2010 their sales totaled EUR 8.9 billion (UPM, 2011*c*). UPM controls both forest and production mills, which makes the main difference from the non-integrated supply chain described above. It is of interest to look closer at which differences there is in green supply chain management in these two types of supply chains.

7.2.1 Green Design

UPM has a vision of becoming the Biofore Company. This have influenced the way they think when designing their products, as they focus on using materials that is more environmentally friendly. Lately they have introduced some new paper products with a greener design as a part of their focus on the environment. The UPM Ecolite, introduced in the beginning of 2011, is a new uncoated catalogue paper based solely on recycled fibre (UPM Annual Report 2011, p. 64). Its design is both low cost and environmentally friendly, and hence a good alternative to other catalogue papers.

Their products are made from three different types of raw materials; chemical pulp (42 per cent), recycled fibre (30 per cent) and mechanical pulp (28 per cent) (UPM Annual Report 2010, p. 26). UPM are using a high share of chemical pulp, which is a natural Biofore

product. Chemical pulp is made from renewable raw materials, can be recycled and generates renewable energy in the production process which is all favorable attributes in terms of the environment.

Developing sustainable products is a part of UPM's goal of achieving competitive advantage. They are for example also working actively to make products without hazardous substances, and have a restricted substances list which they use along the supply chain. In general they are focusing on a complete life cycle assessment of their products, to make them more sustainable throughout the entire process from raw material to end product.

7.2.2 Green Packaging

Neither Norske Skog nor UPM mentioned anything about packaging of paper in their annual reports or on their website. On their products though, UPM recently committed to labeling them with an environmental declaration, so that the customers know which environmental impact their products have.

7.2.3 Green Procurement

UPM is an integrated supply chain, and owns 1.2 million hectares of forestry in Finland and other countries. This implies that they can better control their forests and carry out a common environmental strategy throughout their supply chain. All of UPM's own forests are certified either with PEFC or FSC, and also the majority of the privately owned forests that they source from have been certified (UPM, 2011*d*). Their long-term goal is that 80 per cent of their fiber used for paper production is certified by 2020 (UPM, 2011*e*). According to their annual report for 2010, 78 per cent of the wood that UPM used originated from certified forest, and 79 per cent of the paper produced includes fiber that meets the demands set by either the FSC or PEFC-standard. They promote sustainable forestry, and uses chain of custody and forest certifications to ensure and encourage legal and sustainable logging. Both FSC and PEFC are recognized by UPM, as well as many other international forest certification schemes. They are for example labeling many of their products with the EU eco-label the EU-flower, as well as some other eco-labels.

Although they are an integrated company, they also buy from other suppliers. UPM states that they prefer to work with suppliers who have documented certified environmental system that satisfies the ISO 14001. They have intensified the cooperation with their suppliers, to increase the amount of information concerning the environmental aspects of sourcing for their

company (UPM Annual Report, 2010, p. 39). To ensure supplier cooperation their suppliers must sign an agreement with UPM, which concerns the UPM Code of Conduct stating the environmental requirements UPM has. They claim to have strict regulations for their suppliers, also as a measure to get enhanced knowledge about their products life cycle in order to improve it.

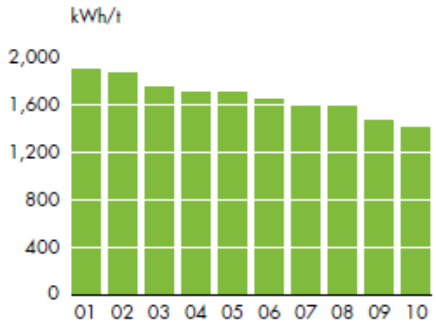
7.2.4 Green Production

UPM is an integrated supply chain, and one can therefore read from their own reports about their environmental achievements throughout the supply chain. They state in their annual report that their production is mainly based on renewable raw materials that are biodegradable and recyclable (UPM Annual Report 2010, p. 58). All of their productions sites as well as their wood sourcing and forestry operations have a verified environmental management system in place (UPM, 2011*f*). As a management system UPM is using the ISO14001, and in addition most of the paper mills in Europe are using the European Management and Audit Scheme (EMAS), which requires regular publication of an environmental statement verified by a third-party.

Energy

UPM is focusing on the usage of renewable energy sources as well as producing products with low carbon footprints. 70 per cent of their power generation is CO_2 emission-free (UPM, 2011*b*), and according to their annual report in 2010 carbon dioxide-neutral energy sources dominate the energy portfolio (UPM Annual Report 2010, p. 59). Their mills use electricity and heat for energy, and many of their mills are combined heat and power plants that are operating paper mills locations.

Figure 7.e: UPM's Electricity Consumption per tonne of Paper



Source: UPM Annual Report, 2010, p.40

UPM has a goal of becoming more energy efficient, and has therefore put several new and energy saving measures into life. In their annual report from 2010 their focus is said to be on smaller investments that will lead to great improvements. As figure 7.e illustrates their actions towards saving energy have paid off, and over the last two years they have achieved a 7 per cent reduction in CO_2 emissions (UPM Annual Report, 2010, p. 40).

Their ambitious R&D program have also been working towards gaining competitive advantage for UPM in the paper market, and one of their two main strategies is to improve energy efficiency in all of their mills by reducing energy consumption by 30 per cent using new technology improving the energy efficiency in the TMP-process. They have also made large investments in renewable energy production, which have increased the usage of biomass-based fuels significantly. Today 80 per cent of the fuels used in UPM Finland is biomass-based, while the share world-wide is 68 per cent (UPM Annual Report 2010, p. 59).

Water

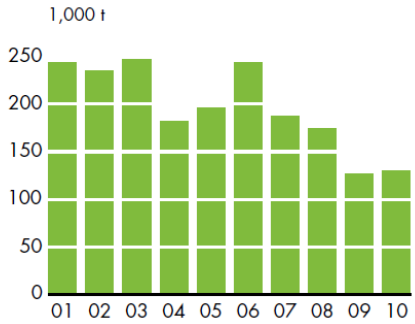
UPM is like Norske Skog and IKEA aware of the fact that water is an important resource and should therefore be taken into consideration when making production greener. UPM has joined several international initiatives that promote water sustainability, like the UN Global Compact's CEO Water Mandate and Water Footprint Network. The water footprint network is interesting, as it has developed a tool for measuring the water footprint of a product when the entire supply chain is counted for (Water Footprint, 2011). However, even though UPM joined the network, their conclusion so far is that the tool developed is not yet suitable for forestry products (UPM Annual Report, 2010). They tried the tool on their Nordland production unit, and it concluded that only 1 % of the water footprint was caused from the actual paper mill production process, while most of the water footprint came from the supply chain.

In general though, UPM has managed to reduce their water consumption by 50 per cent in the paper production process compared to the volume used 15 years ago (UPM Annual Report 2009, p. 41). After being used it is cleaned before returning it to the original source, often cleaner than it was when extracted. They are aiming to be best in the industry when it comes to sustainable usage of water, by measuring effluent quality and net water consumption (UPM Annual Report 2009, p. 53).

Waste

As for waste, UPM has a goal of reducing waste to landfill by 25 per cent in 2020. According to their Annual Report (2010, p. 53), their achievements are so far "in line with the target". As we can see in Figure 7.k the amount of waste to landfill has a decreasing trend over the last few years and in 2010 UPM reused or recycled 90 per cent of their production waste (UPM Annual Report, 2010, p. 60). This is a consequence of several investments made to minimize waste generation, which have made it possible for them to reuse materials for their production to a larger extent. At their mills nearly all organic production residues as well as fibre-containing solids from deinking and affluent treatment, are used in energy generation. Ash left over from energy generation is one of the most significant types of solid waste, and thus reuse of this ash will give substantial environmental benefits. In UPM they use the ash residues in different applications, from road building to construction aggregates. Their strategy is to maximize reuse and minimize waste. Especially pulp and paper production leaves a lot of waste that it is possible to reuse or recycle, either as a new raw material or in energy generation (UPM, 2011*g*). The waste that they cannot use is taken to landfill sites or municipal waste incineration plants.

Figure 7.f: UPM's Total Waste to Landfills



Source: UPM Annual Report, 2010, p. 61

7.2.5 Green Logistics

Every year UPM receives and transports high volumes of raw materials, waste and end products to the customers. For this transportation, UPM uses road, ship or rail. Which transportation mode they choose depends on the distance and delivery time. Unlike Norske Skog and IKEA, UPM does not specify the amount used by each transportation mode in their sustainability reports. Consequently, it is difficult to know which transportations modes they

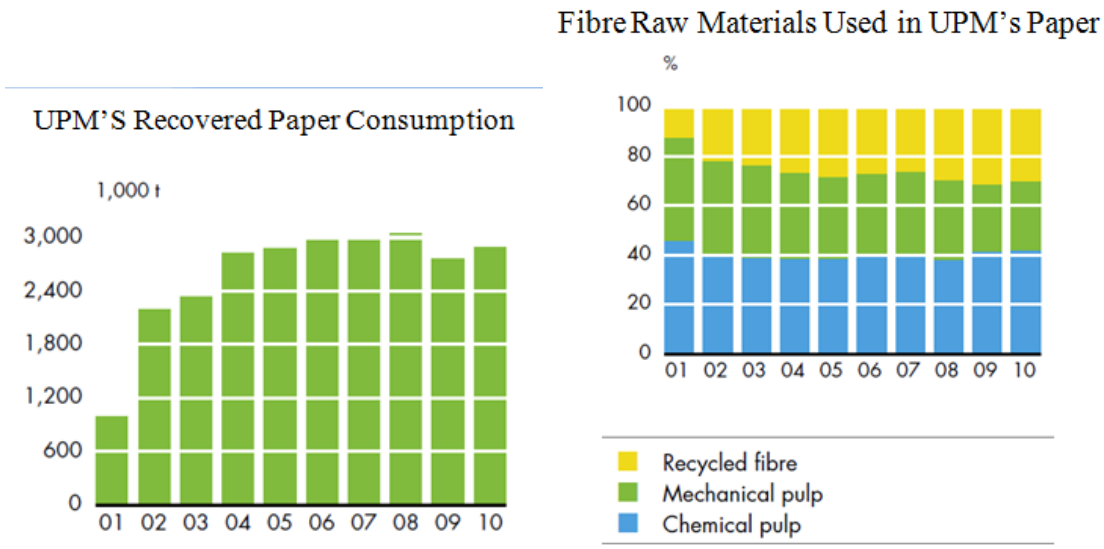
use the most. Like Norske Skog, UPM does not report their filling rate. Additionally, they do not specify how high their greenhouses gas emissions are from their transportation.

7.2.6 Recovering, Reusing and Recycling

Paper

According to UPM's Annual Report (2010, p. 25), UPM is the world's largest user of recovered paper in the production of graphic papers. UPM consumed 2.9 million tonnes of recycled fibres for their newsprint and uncoated and coated magazine paper production; however it is mainly used in the production of newsprint and SC paper. In total, recycled fibres represent 30 per cent of all fibre material in UPM's paper production. Compared to Norske Skog, UPM has a lower recycled fibre share (Norske Skog 34 per cent), however their consumption is almost twice as much as Norske Skog's consumption which is 1.5 million tonne.

Figure 7.g: Recovered Paper use at UPM



Source: UPM Annual Report, 2010, p. 25

Bioenergy and biofuel

Together with Metso and Fortum, UPM has worked with the Technical Research Centre of Finland (VTT) to develop a new concept for the production of energy wood-based biofuels as an alternative to fossil fuels. This biofuels can be used for both electricity production and as transportation fuel. When produced, UPM will integrate the biofuels into their own biomass based power plants (UPM, 2011*h*). UPM has patented this technology used in combined

biofuel and renewable energy production (UPM, 2011*i*). UPM has estimated that they would be able to reduce their emissions with 85 percent throughout their supply chain if they change to wood-based biofuels from fossil fuels (UPM, 2011*j*).

UPM is about to decide whether they shall make an investment in a liquid refinery which would be located at their Kaukas pulp and paper mill site in Finland. By placing the bio-refinery adjacent to the pulp and paper mill UPM will be able to enhance the ability to utilize wood as raw material efficiently and minimize the required capital investments. According to the environmental impact assessment, the bio-refinery will not cause a significant environmental impact (UPM, 2011*k*).

Thermal energy

Similar to Norske Skog, UPM reuses energy over and over again through heat recovery systems. As one can see from table 7.f, 1.7 per cent of the fuels used for heat generation at the mills came from energy recovered from the thermo-mechanical pulping process in 2010. Consequently, while UPM had an increase of 0.2 per cent in their use from 2009, Norske Skog experienced a reduction in their use of energy recovered from the TMP process around one per cent from 2009 to 2010.

Table 7.f: Fuels Used for Heat Generation at the Mill Sites

TWh	2010	2009
Black liquor	16.3	9.4
Bark and other biomass	8.3	7.7
Heat recovered from TMP production	1.7	1.5
Peat	1.0	0.9
Purchased heat	0.2	0.2
Natural gas	6.9	6.3
Oil	0.5	0.3
Coal	3.1	3.0
Total	38.0	29.3

Source: UPM Annual Report, 2010, p. 19

Water

In contrast to Norske Skog, UPM does not report their reuse and recycling share of their water use, but they do mention that they treat all wastewater before they discharge it back into the water cycle (UMP, 2011*l*).

Waste

UPM had a 90 per cent recovery and recycling rate for their production waste in both 2009 (UPM Annual Report, 2009, p. 64) and 2010 (UPM Annual Report, 2010, p. 60). UPM's share is slightly lower than Norske Skog's recovery and recycling share both in total and in Europe.

7.3 Summary Table of the Case Studies

The Non-Integrated Supply Chain	*The Integrated Supply Chain*
Green Design - Made a reduction of catalogue size in 2009 - First major color publication printed on TCF paper	***Green Design*** - Have introduced new paper products with a greener design
Green Packaging - Little or no information on how they pack the catalogues - Have no environmental labels on their products	***Green Packaging*** - Label their products with environmental declarations
Green Procurement - Norske Skog recognizes PEFC, FSC, ISO 14001 standards and declarations proving that the forest are managed in accordance with national laws and regulations - NORTØMMER: 100 per cent certified by PEFC - Norske Skog: 76 per cent certified fresh fibre in 2010. - IKEA: 21 per cent of the catalogue suppliers FSC CoC-certifications	***Green Procurement*** - Recognizes both PEFC, FSC and other international forest certification schemes - All of UPM's own forests are certified with either PEFC or FSC - 78 per cent of their fresh fibre is certified by PEFC or FSC - 79 per cent of their fibre is certified by PEFC or FSC
Green Production	***Green Production***
Energy - Norske Skog experienced an increase in their energy consumption in spite of focusing on energy and efficiency due to the sale of the Chinese mill which only used recycled paper - A decrease of 0,08 kWh in the production of the IKEA catalogue from 2009 to 2010	Energy - 70 per cent of their power generation is CO_2 emission-free - Focuses on energy saving measures - Uses new technology to improve energy efficiency in the TMP-process - Made large investments in renewable energy production
Water - Norske Skog: 92 per cent from surface water, 8 per cent ground water and a very small part from municipal water - A decrease of 3,86 liter water per copy of the catalogue from 2006 to 2010	Water - Joined the UN Global Compact's CEO Water Mandate and Water Footprint Network - Reduced their water consumption with 50 per cent the last 15 years - No information on water sources

Waste Residues - Norske Skog: increase of 1 kg/tonne from 2009 to 2010, explains it with higher production volumes and are targeting a decrease of 2 kg/tonne in 2011	Waste Residues - Strategy: maximize reuse and minimize waste - Goal: reducing waste going to landfill with 25 per cent in 2020
Green Logistics - Say that they try to choose environmental friendly transportation modes when possible, however trucks are the dominant transportation mode for all three parties - Norske Skog received criticism from Friends of the Earth Norway for their usage of trucks - Norske Skog have experienced an increase in their direct emissions from transportation and mobile source from 2007 - IKEA's filling rate was between 60 to 64 per cent in 2010	***Green Logistics*** - Transportation mode depends on the distance and the delivery time - No information on amount used by each transportation mode, their filling rates or how high their greenhouse gas emissions caused by transportation
Recovering, Reusing and Recycling	***Recovering, Reusing and Recycling***
Paper - Norske Skog: recycled fibre share was 34 per cent in 2010 (1.5 million tonnes) - Saugbrugs only uses fresh fibres in their production - IKEA catalogues: recycled fibres share was 11 per cent in 2010	Paper - Recycled fibre share was 30 per cent in 2010 (2.9 million tonnes)
Bioenergy and Biofuel - NORSKOG: Bio Oil AS - Norske Skog: terminated their Xynergo project in 2010	Bioenergy and Biofuel - Participates in a collaboration to develop a new concept for the production of energy wood-based fuels - Deciding if they are going to invest in a liquid biorefinery
Thermal Energy - Norske Skog: 9 per cent of their energy consumption came from the TMP process in 2010	Thermal Energy - 1.7 per cent of the fuels used for heat generation at the mills came from energy recovered from the TMP process
Water - Norske Skog: 96 per cent of the water entering their mills is returned to the water cycle and 4 per cent is either returned to the atmosphere as vapour, retained in the products or used for irrigation of forest plantations or agricultural areas - IKEA: no information about their reusing and recycling share of water	Water - No information on their reuse and recycling share of their water usage - Say that they treat all wastewater before they discharge it back into the water cycle
Waste - Norske Skog: reuse and recycling share of waste was approximately 95 per cent in 2010 in total and almost 100 per cent in Europe	Waste - Reuse and recycling share of their waste was 90 per cent in 2010

7.4 General Discussion

7.4.1 Green Design

Most companies focus on the reduction of weight and volume when they look at green design. However, these environmental improvements only form one small part of green design. They should therefore try to widen their perspective and focus on more aspects of green design, something UPM seems to have realized. Alongside their vision of becoming the Biofore Company, they have introduced new paper products, for example a new uncoated catalogue paper based solely on recycled fibres. They also use high shares of recycled fibres and chemical pulp, which is made from renewable materials, can be recycled and generates renewable energy. UPM is also continuously working on eliminating hazardous substances from their products and have won prices for environmental innovation solutions. Another company that looks at all the aspects of green design is Cascades. On their web pages they have a section dedicated to environmental papers where you easily can find different types of papers with an environmental profile (Cascades Paper, 2011*a*).

In general, it is quite hard to identify if the companies in the pulp and paper sector have a focus on green design when developing their products. Except from Cascades, it does not seem like green design is an important part of their business strategy. This is a pity, since one can achieve large reduction of greenhouse gas emission and more efficient production by having green design in mind. One would therefore assume that more companies would have a larger focus on green design in their environmental sustainability solutions; nevertheless this is not the case.

7.4.2 Green Packaging

As mentioned earlier under 7.1.2 Green Packaging, neither Norske Skog nor UPM mention anything about packaging solutions for their paper publications in their sustainability reports or on their web sites. Of all the paper and boards being produced, 50 per cent of it goes to packaging products (WWF for a living planet, 2011*b*). Products designed for packaging seem to be under the same environmental focus as all of the other paper products that the companies in the paper industry have. Nevertheless the paper producers do not mention packaging of their own products in their public reports. IKEA mentions their packaging solutions for their furniture business, but not for their catalogues. It seems like there might be a larger share of public demand for more environmental packaging when it comes to daily

consumer goods. Most companies do not mention their packaging solutions for their paper publications in public available information. Packaging is more or less only mentioned if the companies sell packaging solutions.

As for labeling, UPM recently committed themselves to label their products, so that the customers will know which environmental impact their products have. This is something IKEA has been criticized for not doing since they believe the IKEA logo should be sufficient proof of the product's environmental impact. However, if all companies had the same attitude as IKEA, it would be almost impossible for the consumers to know the environmental impact of the products they are buying without doing a lot of research.

7.4.3 Green Procurement

As our description of the environmental policies and the case studies shows, thinking green when procuring has become of great importance for businesses, especially within the paper industry. Generally, the importance of sustainable forests management has achieved increased awareness over the last few decades, especially since IPCC have documented that human activities influence the climate change. Forests are of great importance for the climate, and therefore industries using wood as a raw material is under pressure for acting more sustainable and thinking about the environment.

When studying the different companies above, it is quite clear to us that certification is of high importance. Our case study shows that both PEFC and FSC is recognized of the forest owners (NORTØMMER and UPM), as well as the paper producers (Norske Skog and UPM). Globally the area of PEFC-certified forest is twice as large as FSC and it is therefore naturally harder to obtain FSC-certified wood (Norske Skog Annual Report 2010, p. 24). IKEA only recognizes FSC as a credible system, which might explain why they have a much smaller share of certified material in their production.

Although forest certifications are supposed to guarantee that the forest is sustainably managed, there have been several incidents showing the shortcomings of these certifications. Quite recently a Swedish radio program revealed by looking at satellite photos that Stora Enso and Sveaskog, two large paper producers, are sourcing wood from areas regarded as important habitats for endangered species (Sveriges Radio, 2011). They are both certified after the FSC-standard, however if the accusations are true this implies that they are not fulfilling the FSC-requirements. Another controversial issue for the FSC-system was when they acknowledged

that Asian Pulp and Paper (APP) was using their label, but still destroying pristine forests. Some environmentalists claimed that if APP could get FSC accredited, then there had to be something wrong with the system (Wright & Carlton, 2007). Issues like these damages the credibility of the system.

The industry is more open for different certification systems and prioritizes what is required of them by the government and the market. As NORTØMMER says it; "we will do what the market demands". The paper producers we have been studying seem to be indifferent in regards to which certification they prefer, but they emphasize that they prefer to source wood that is sustainably managed. In other words, they accept wood from forests managed according to national regulations. When seeing that only approximately 7 per cent of the world's forest is certified with either two of the forest certification systems, paper producers would have a problem getting enough wood if they could only buy certified wood. We see that there are large regional differences when it comes to amounts of certified wood. In Europe and North-America there is a much larger share of certified forest than the rest of the world, still the forests in for example South-America and Russia is sold although not certified. Clearly, being certified is not required in order to be a part of the market. However, in the areas which have the highest share of certified forest, the government often has stricter regulations that are in line with for example the PEFC-certification, and hence the forest owners do not have much choice than to fulfill the criteria.

The paper producers put an extra effort in promoting the share of PEFC and/or FSC certified forest and fibre that they use. It appears like the label itself is an important part of their branding. In Norske Skog, UPM and IKEA's sustainability report, as well as on their website, it is easy to find information regarding the share of certified forest. This is not true for all companies in other regions, like Chile. The large, integrated pulp and paper company, CMPC, publish a sustainability report unlike their rival Arauco. However, it does not contain any concrete numbers on the share of certified forest which would have given shareholders a better insight in the actual shares of certified forest. Despite their lack of informative facts in their sustainability report, they are still far better than their competitor, Arauco, which is even more short on words when it comes to sharing information about their environmental focus areas as they do not even have a thorough section about sustainability on their web page.

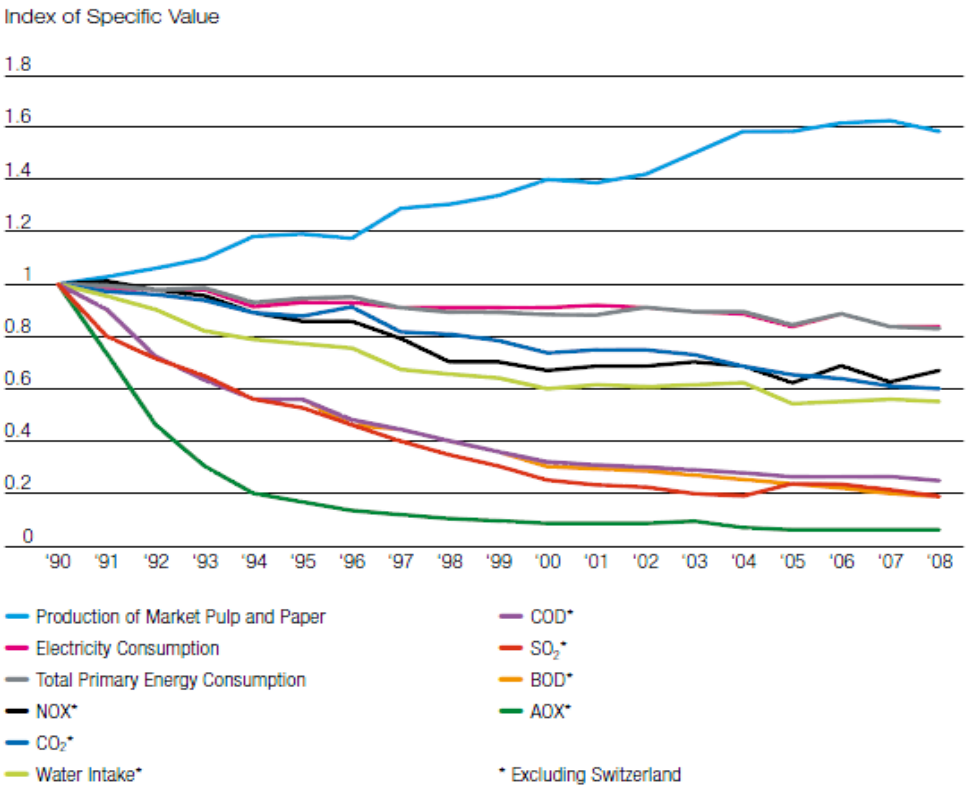
We see that having a chain-of-custody certification for products is a focus area for the businesses in the industry, as a response to both customers and other stakeholders like

environmental organizations, governments and the international society's awareness of the environmental issues we are facing today. Thinking green when procuring is of increased importance for both of the supply chains we are focusing on.

7.4.4 Green Production

The production of paper is as mentioned a very energy consuming process that also requires large amounts of water and creates a large volume of waste. During the last decades the industry seems to have gone through some important changes when it comes to the production processes so that they are much more efficient and continuously improving. Most paper producers have for example reduced energy and water consumption as well as reduced waste. Emission reduction targets are common, and the main strategies for reaching them concerns reducing emissions in the production process. The graph below is taken from CEPI's Sustainability Report 2009, and shows how paper production has increased over the years, while emissions are reduced for European producers. Obviously, technological improvements have been successful, but there is still a lot more potential for improvements in the production processes in terms of making it greener.

Figure 7.h: The relationship between paper production and emissions for the CEPI members



Source: CEPI Sustainability Report 2009, p. 20

Energy

Energy usage in production and the source of energy is the main contributor to greenhouse gas emissions in the production process. Hence this is also the main focus when planning for greenhouse gas reduction. When looking at the process, it is of interest to know both the amount of energy used as well as the type of energy. There is a lot of available technology, and also the increased use of recycled fibre for paper production has reduced the need for energy in the paper production process. Nevertheless we see that Norske Skog has increased their use of energy per tonne, and explains this by the sale of their Chinese mill which only used recycled fibre for production. However, the Canadian paper producer Cascades has managed to use only 10.95 GJ/Metric tonne (Cascades, 2011*b*), which is far lower than Norske Skog's 12.56 GJ/Metric tonne. It is therefore reasonable to assume Norske Skog has a certain reduction potential.

UPM is steadily decreasing its energy consumption, and claims to have several smaller investments in place to make the production more efficient. UPM has for example installed combined heat and power plants, a measure to reduce energy consumption.

In Norske Skog's annual report it is possible to extract the different shares of energy sources, but for UPM they do not have any statistics on this. It is therefore hard to make a good comparison, since UPM only writes that the majority of their energy comes from renewable sources. Worth mentioning though is that they focus on their low carbon footprints as they claim that 70 per cent of their power generation is CO_2 emission free. However, the environmental organization, WWF, states that they urge the industry to calculate the net figure for its carbon footprint, and not assume that renewable energy is carbon neutral (CEPI Sustainability Report, 2009, p. 12).

The IKEA-catalogue, through improvements done by its suppliers as well as the catalogue designers from IKEA, has reduced its energy usage. This illustrates that product design is important in the work towards less emissions throughout the supply chain.

Water

Compared to the situation 15 years or longer ago, the water consumption of the paper industry today is greatly improved. In general, the paper producers mostly "borrow" water from the water cycle, and then replace it with sometimes even cleaner water. Especially in the developed countries there are strict regulations concerning the quality of the water returned from a mill. If a company pollutes the water around their mill, their brand and image might

suffer from a bad reputation if it catches the public's attention. Therefore the paper producers also producing in countries where regulations are not that strict seem to have the same policy for all of their business units, wherever they are located.

An interesting innovation is the water footprint tool that is under development. Neither Norske Skog nor IKEA mentions it, but UPM has tried it for one of their units as they cooperated with the Water Footprint Network. CEPI is also working on making a water reporting guideline for the paper industry, as a measure of improving water security.

Waste

Reducing the waste to landfill has been the main challenge for the industry, as the production process generates large amounts of waste. New innovations of technology have made it possible to make use of the waste though, and the paper producers are therefore continuously trying to reuse or recycle most of their waste. Especially the usage of waste for biofuel is something Norske Skog, UPM and other paper producers are doing. However, Norske Skog does not seem to be successful when trying to reduce waste to landfill as the numbers has increased over the last few years. It is especially the production process with recycled paper that creates a lot of waste, because of the deinking process. It seems therefore somewhat strange that they sold their Chinese mill that used only recycled paper, and still the amount of waste to landfill is increasing. Unlike for water, the waste handling is not the same in different regions of the world. Due to taxes and regulations in Europe, small amounts of waste goes to landfills compared to for example in Australasia and South America.

7.4.5 Green Logistics

UPM is not the only company which does not report the amount used by each transportation mode. Actually, Norske Skog, IKEA, Svenska Cellulosa Aktiebolaget (SCA) and Stora Enso are one of few who reports actual amount used. Other industry leaders normally only report types of transportation used and mention that they have logistics systems in place to minimize transportation distances and costs. However, the companies should focus more on having the right transportation modes rather than distances. Some of the companies also report measures such as buying more fuel efficient trucks, and trying to choose trains whenever possible. Very few mention anything about filling rates, which is a vital question as it says something about the efficiency of the transportation and hence the degree of environmentally friendliness that they are achieving when transporting. All things considered, it seems like the companies prioritize profitability the most and not necessarily the environment.

According to calculations made by Stora Enso in their Sustainability Report 2010, it is actually more environmentally friendly for them to ship eucalyptus pulp from Brazil to Europe compared to use hardwood pulp produced in Europe. It is therefore important that the supply chains not solely focus on minimizing transportation distances, but look at the entire process from transportation of trees to the mills, all the production processes and the transportation of pulp to its final destination before they choose which option is more environmentally friendly. On the other hand, it is important to take into account that one of the main reasons why the pulp from Brazil is more environmentally friendly, is because they produce most of the chemicals that they need on site. However, this should also be a possibility for European mills.

7.4.6 Recovering, Reusing and Recycling

Paper

Since 2000, the growth in the paper recycling rate has been three times that of total paper consumption in Europe and today the paper recovery rate is 72 per cent (European Recovered Paper Council, 2011*a*). This is a quite high rate taking into account that it is estimated that 19 per cent (European Recovered Paper Council, 2011*b*) of the paper that we use is not possible to collect or recycle.

In general, the European companies' share of recycled fibres varies from the high twenties to almost 50 per cent. This represents volumes from less than one million up to four million tonnes. The Canadian company Cascades has a very high share of recycled fibre content of 75 per cent which represents 2.6 million tonnes (Cascades Summary Table of Performance Indicators, 2011). In other words, there should be a potential for the European companies to increase their shares. On the other hand, the European companies are larger and consequently even though their shares a lower, the volumes are bigger. It might therefore be difficult for the European companies to increase their shares significantly due to a limited supply of recycled fibre. One also needs to take into account that 70 per cent of the waste generated originates from the production of deinked paper. In other words, one has to compare the benefits of energy savings and the disadvantages of generating more waste when the companies decides how much recycled fibres to use in their production. However, waste can be reused as biomass for energy production.

As mentioned, Norske Skog uses 1.5 million tonnes of recycled fibres which is 34 per cent of their fibres, IKEAs share of recycled fibres is 11 per cent which represent 11,300 tonnes, and UPM uses 2.1 million tonnes which is a share of 30 per cent. Norske Skog and UPM are therefore not the best nor the worst. They have quite big volumes and shares, however they also have a potential to increase their use of recycled fibres. On the other hand, IKEA has a low share of recycled fibres and therefore a potential to improve.

Bioenergy and biofuel

As mentioned earlier, NORTØMMER, Norske Skog, IKEA and UPM have or are presently investing in projects researching the possibilities of biofuels which seems to be the general trend in the paper industry. Other major players such as SCA, Sappi and Stora Enso are making similar research investments. This might be a consequence of EU's effort to reduce emissions from fossils fuels, which consequently has increased the demand for biofuel. CEPI is in turn skeptical about using too much wood for bioenergy and biofuel as it may lead to distortions in the wood market and increase wood prices.

Thermal energy

Both Norske Skog and UPM report in their sustainability reports how much of their energy consumption that comes from energy recovered from the thermo-mechanical pulping process. However, it seems like this is not the general trend. It is actually only a few companies, such as the Danish company Holmen, that report their energy use from energy recovered from the TMP process.

Water

Water is a scarce resource, and consequently there is a lot of focus on the usage of water. Most companies report how much water they use from what resource. However, not all report on how much of this water is returned back to the aqua cycle. Neither IKEA nor UPM reports their reuse and recycling rate from their water usage. Norske Skog, on the other hand, reports that 96 per cent of the water entering their mills in 2010 was returned to river and lakes after treatment. For the European companies which report their water recycling rate, it seems like most of them recycle 90 per cent of it or higher. Consequently, one can conclude that Norske Skog has a quite good recycling rate.

Waste

Every year the European pulp and paper industry generates millions of tonnes of waste. Most European companies reports that they recover and recycle more than 90 per cent of their

waste, with the majority going to energy recovery. Norske Skog, IKEA and UPM have recovery and recycling rates of 90 per cent and higher. All things considered, it seems like European companies have quite high recovery and recycling rate for their waste. This might be a consequence of stricter legislations and higher taxes in Europe, as companies from other continents, such as CMPC from Chile, sends 82.4 per cent of their waste to landfills (CMPC Sustainable Development Report, 2009, p 94). However, not all European companies report how much waste they recover and recycle, but some of them report what their reduction targets are for waste going to landfills.

8. Cooperation within the Supply Chain

A non-integrated supply chain consists of different units and owners, which makes it challenging to cooperate and share information. By sharing the same reporting systems, a non-integrated supply chain can more easily control, understand and receive information from the other participants. It makes it easier for the participants to see if their suppliers, manufactures or customers comply with their requests and influence each other. Norske Skog uses the Global Reporting Initiative (GRI) for their environmental reporting. IKEA on the other hand, are exploring the possibility to develop global supply chain standards through their partnership with the Global Social Compliance Programme (GSCP). NORTØMMER is a relatively small company and do not have any international reporting systems that they follow. As one can see, there exists no environmental reporting consensus in this supply chains. As most of the companies in the pulp and paper industries reports after GRI principles, IKEA should consider using the GRI principles for their environmental reporting. However, IKEA is a part of many different non-integrated supply chains and some of the other supply chain partners might use GSCP or other similar systems. It is therefore important for IKEA to take this into consideration when they chose how they report their environmental parameters.

Asian Pulp and Paper (APP), one of the biggest pulp and paper company in the world, claims that their carbon footprint is “close to neutral”. However, Rainforest Action Network (RAN) and Japanese Tropical Forest Network (JATAN) found it to be too good to be true that the biggest pulp and paper company in Indonesia, which is responsible for 25 per cent of the deforestation emissions in the world, credibly could claim to be making virtually “carbon neutral” paper and decided to take a closer look at the company. It turned out that APP had not included emissions from logging, clearing forests, or from decomposition of peat soils. RAN and JATAN calculated that APP’s carbon footprint was somewhere between 550-700 times higher than APP’s calculations (Lang, 2010). This shows that one cannot take all the calculations made by other players in a supply chain for granted. However, by using a common reporting standard one can reduce this problem significantly.

Sustainability reports are also an important tool for increasing transparency in the supply chain. In the non-integrated supply chain, NORTØMMER does not have a sustainability report, while both Norske Skog and IKEA have. Norske Skog’s sustainability report is informative and they report the same numbers every year and have been awarded for their openness around their environmental profile. IKEA on the other hand, has a sustainability

report which is far more confusing. In the case studies above we mentioned that 21 per cent of IKEA's catalogue suppliers are CoC-certified after the FSC-certification. This number was found in their sustainability report from 2010, and had the label "FSC Certified CoC fibre (%)". For those being interested in finding these numbers from earlier reports, one might find it confusing as they use different numbers and slightly different naming in the different reports. In the 2009 report they give us the numbers for "Fibres with FSC certified CoC (%)", which is 6 per cent in 2009, and the previous years from 2006 – 2008 respectively 3.4, 7.6 and 5.9 per cent (IKEA Sustainability Report 2009, p. 25). What makes it more confusing is that if you then have a look at their 2008 report, there is another set of numbers reported called "Fibres from FSC certified forests", which does not match any numbers from neither the 2009 nor the 2010 report. This sort of reporting makes it difficult for customers, external stakeholders and other supply chain participants to know exactly what is meant by the different numbers. If these sustainability reports are only to show the "nice" numbers then it becomes confusing and does not give a correct picture of the company's environmental profile.

Table 8.a: IKEA Catalogue Requirements Approved Suppliers

	FY07	FY08	FY09	FY10
IKEA Catalogue Requirements approved suppliers, %				
IKEA Catalogue Sustainability Requirements, approved suppliers	70	71	73	86
Industry-specific requirements, approved suppliers	54	53	50	65

Source: IKEA Sustainability Report 2010, p. 51

IKEA created a code of conduct called IWAY which their suppliers have to follow. As mentioned earlier, IKEA checks on an annual basis if their catalogue suppliers follow the IWAY requirements by sending out a questionnaire and in 2010 they decided to also conduct systematic audits of the suppliers. IKEA tries to follow up their suppliers, but does a questionnaire really give them good and reliable information? Will their suppliers answer it with openness and accuracy? Another issue is that IKEA does not control their sub-suppliers; companies supplying services, raw material, components, and/or production capacity to an IKEA supplier. IKEA places the responsibility on the IKEA suppliers to ensure that their sub-supplier acknowledge, understands and accepts the IWAY requirements (IKEA Sustainability Report 2010, p. 41). This means in practice that IKEA never controls NORTØMMER if they

follow their requirements. They give this responsibility to Norske Skog, and it seems like they follow more or less all of IKEA's IWAY requirements and so does NORTØMMER. However, all of IKEA's suppliers *do not* fulfill all of their requirements and consequently they might have sub-suppliers not fulfilling their requirements. As one can see from table 8.a, in 2010 86 per cent of IKEA's catalogue suppliers were IWAY approved and only 65 per cent fulfilled the industry-specific requirements. In other words, 14 per cent and 35 per cent of the suppliers were not IWAY approved or industry-specific approved. One can then ask the question; how many sub-suppliers of IKEA fulfill either their IWAY requirements or the industry-specific requirements?

In 2010, Stora Enso was ranked number one on The Nordic 200 Carbon Disclosure Leadership Index by CDP. One would therefore assume that products from Stora Enso would be environmentally friendly and that the company uses environmental sustainable solutions. Nevertheless, as mentioned earlier it was recently revealed by a Swedish radio program that Stora Enso and Sveaskog sourced wood from areas regarded as important habitats for endangered species. News like this can hurt a company reputation severely and sometimes even destroy it. It can also affect the reputations of other players in the supply chain. It is therefore important for a company to have knowledge about their supply chain and their activities. A 100 per cent vertical integrated supply chain will not face this problem as all the stages in the supply chain is controlled by the same owner who sets the requirements which the entire supply chain have to follow. However, it is extremely rare that companies from the pulp and paper industry are 100 per cent integrated and hence they will also have to consider how to control non-integrated participants in their supply chain.

9. Environmental Strategic Framework

In chapter seven, Green Supply Chain Management Case Studies, we have investigated which measures are being done to become more environmental sustainable by companies in the pulp and paper industry. We have used these findings to create a simple framework for companies to identify their strengths, weaknesses, opportunities and threats. To illustrate how mapping of these characteristics can be used we have conducted a TOWS analysis to develop some key environmental strategies. The SWOT and TOWS analysis have been conducted for the non-integrated supply chain, since this is the main focus of our study. The analysis, as with the entire paper, is done based on public information we have found about the supply chain. Despite its limitations, we have been able to extract important characteristics that can be further used to define different strategic options in the TOWS analysis.

The questions listed serves as a simple framework that may be used for a supply chain that wants to develop a greener strategy. Please note that the framework does not have a complete set of questions, but serves as an example of a framework that can be developed and should be further extended to give the holistic picture of the supply chain. More questions should be generated, adding on the specific internal and external factors that surrounds their organization. Since we have only been gathering public information to conduct our analysis a company doing it themselves will naturally have more information about the different parts of the supply chain. They should go through each part of the supply chain, as we did in chapter seven, and have a look at what they are doing in order to become greener. The next step will be to compare themselves with their rivals and gather information about the market conditions and the industry trends for the future. During this process they might identify more factors that are important for the greenness of their supply chain. By adding more questions to the SWOT analysis there will be a better foundation that makes it easier to find good strategic alternatives through the TOWS analysis.

9.1 SWOT-Analysis

Green Supply Chain Management

Do we expect an increase or decrease in demand for paper and catalogues in the future?

The paper industry was hit quite badly by the financial crisis, and paper production plunged in 2008. Since mid-2009 the production has increased again, and seems to have stabilized itself on a lower production level than before the financial crisis. Some types of paper, like toilet

paper, do not have a good substitute and hence there is no reason to believe demand will decrease. However, paper that can be substituted with new technological innovations is experiencing a decreasing trend as the E-media is continuously improving. This also counts for catalogues, which to a large extent is possible to obtain online. Since environmental organizations are putting a larger pressure on catalogue distributors, there is reason to believe that online versions of catalogues will be more and more common. Actually IKEA's catalogue is already available online, and you can even get it as an application on mobile phones.

For the non-integrated supply chain this can have both positive and negative consequences. The negative aspect is that a paper business already in decline will suffer if catalogues are substituted by online versions as less paper will be demanded. However, catalogue production generates a lot of waste and emissions, and hence seen from an environmental perspective less catalogues implies less greenhouse gas emissions. Nevertheless, one can argue which is worse; paper or electronic gadgets. If one makes a comparison of both supply chains the answer is not obvious. Paper is made by a renewable raw material, and is a recyclable product, which is not the case for electronic gadgets. They are made by metal components and plastic parts, and have a low recovery and recycling rate. The increased use of electronic gadgets is actually creating a waste problem. When looking at greenhouse gas emissions in the paper supply chain, these are caused by the energy usage in the paper production process. For electronic gadgets it is mainly the use of the device that creates emissions, which is in favor of the electronic media industry as emissions from use are quite low per unit. Also, it is argued that paper production causes deforestation; however, in Europe where forests mainly are managed sustainably the forest is increasing every year. The different arguments prove that both have their positive and negative sides, and it is not necessarily the case that the reduction of paper saves the environment, as paper might be substituted by less environmental friendly products. As of today, there is not a reason to believe that there will be a rapid decline in the use of catalogues for marketing, as it is still IKEA's most important element in their global marketing campaign. However, due to the general decline in paper consumption and an adaption to more use of E-media, it seems like the paper industry is facing a decline in the demand for catalogues, which is a threat for the non-integrated supply chain.

Do we expect an increase in demand for green products?

Green products and sustainable development are receiving more attention, and the different players in the paper industry seem to have increased their environmental profile a lot just over

the recent years. Recycled paper products are already an established part of the market, and Norske Skog already has several products containing recycled materials. Nevertheless, as we have pointed out the non-integrated supply chain we have been studying is not amongst the frontiers in green product development necessarily, although IKEA recently introduced a more environmentally friendly catalogue format. Looking at best practices in the industry we have noticed that some companies is continuously working on developing greener products, as they also have finer papers with an environmental profile. For example, the North-American paper producer Cascades already has an easily identifiable portfolio of environmental paper products. UPM focuses on greener design, and in general it seems to become the trend in the industry. It is reasonable to assume that the demand for greener products will increase in the future, and it is therefore essential for producers and distributors to have a focus on sustainable development of their products. The expected increase in demand for green products represents an opportunity for the non-integrated supply chain to become greener as there are possibilities to develop the catalogue so that it becomes a greener product.

Is our product perceived as a green product?

Catalogues have received a lot of attention by environmental organizations over the last few years, as there have been revealed misbehavior by certain catalogue distributors from an environmental perspective. The IKEA catalogue is used for promotion, and in general advertisement material are usually perceived as waste for consumers. Still the IKEA catalogue is a valued publication by consumers globally, and the customers do not seem to question the greenness of a catalogue to a large extent. Environmental organizations, on the other hand, are in general in favor of less paper usage and such big publications distributed in 197 million copies globally are therefore something they might want to take a closer look at.

As catalogues are an important marketing tool, many catalogue distributors have seen the need to focus more on environmental improvements for their catalogues to avoid conflicts with environmental organizations as it is seldom positive for their brand and image. Although IKEA and the rest of the non-integrated supply chain are focusing on becoming greener, the increased awareness from environmental organizations represents an external threat. Above we described how ForestEthics ran a tough campaign aimed at Victoria Secret's catalogues because they were made from wood originating from endangered forests. This demonstrates that environmental organizations are aware of the catalogue business, and might run a deeper check on other catalogue distributors.

As of today the non-integrated supply chain is not transparent enough both internally and for external stakeholders to be sure that all activities and processes hold the required level of environmental friendliness. If an environmental organization decides to scrutinize the different supply chains leading to the IKEA catalogue, it is not certain that they will find only environmentally friendly suppliers. As mentioned earlier IKEA does not check their sub-suppliers and hence rely on their own suppliers to have sufficient control. We know that in certain regions of the world regulations and laws are not very strict, and hence there might be easier to conceal unwanted behavior for the buyers. This threat is therefore highly relevant, and something the non-integrated supply chain we have been studying should be aware of.

Do we cooperate with any non-profit environmental organizations?

Cooperation with a non-profit organization might be valuable for a supply chain as they will have an external stakeholder who can help them become greener. IKEA are for example cooperating with WWF on a climate project that is aiming to make their entire supply chain greener. Norske Skog does not have such a cooperation project with any organizations at the moment, while UPM is a partner with WWF in their "new generation plantation" project with the aim of promoting best practices for the design and management of forest plantations (UPM 2011*d*). However, IKEA's cooperation with WWF is a large project aiming at improving the entire supply chain for them, which then should also include the specific non-integrated supply chain we are looking at. Such cooperation is valuable and we see it as a strength for this supply chain that there already are processes working on improving its greenness.

How, if any, do we measure our greenhouse gas emissions? And if you are measuring, how many scopes do you include?

There is no public information available saying if NORTØMMER is measuring its greenhouse gas emissions. Norske Skog on the other hand, is measuring its emissions and using the carbon footprint tool developed by CEPI for the paper industry. This tool is used by several of their closest competitors as well. However, UPM does not clearly state which scopes they include in their calculations, other than listing them up. Also, it is not easy to find information on what Norske Skog's total carbon footprint is. The total carbon footprint for their company is measured only by including scope one and two emissions in their wholly owned mills. Since it does not include scope three and other parts of their business where they have some owner share there is potentially more emissions that should be counted for by Norske Skog. However, Norske Skog was recognized in 2010 by the Carbon Disclosure

Project as number one when it came to their climate change strategy and the reporting of their greenhouse gas emissions, which indicates that they are among the best in class.

IKEA is measuring its carbon footprint using the Greenhouse Gas Protocol's tool, and has recently started including all three scopes. They are currently cooperating with WWF in order to reduce their carbon footprint through different measures.

In general it is difficult to compare different company's emissions, as there is not one standard that everyone uses. However, it seems like the other companies in the pulp and paper industry, like Cascades, Stora Enso and UPM all report and measure their greenhouse gas emissions. Also Arauco in Chile measure their greenhouse gas emissions and calculates their carbon footprint. It therefore seems to not necessarily be a strength for our supply chain that we are measuring our footprints, but more a need in order to still be attractive for investors and customers.

Is the carbon trading system influencing our business?

Following the Kyoto-protocol was the three mechanisms supposed to help achieving the required carbon cuts in the developed countries that signed the treaty. The aim was to reduce emissions and stimulate new and greener technological developments. EU ETS is the largest carbon market in the world, and Norway is one of the members of this market. In Norway not all industries are included in this system yet, but the ones who are is responsible for 40 per cent of Norway's greenhouse gas emissions (Klima- og Forurensingsdirektoratet, 2011*b)*. One of the industries included in the Norwegian emission quota system is the wood-processing industry, and hence the non-integrated supply chain is influenced by the carbon trading system. As the system stands today, it seems that the quota roof is quite high, and therefore the demand for carbon quotas is not very large. The price of one quota is therefore not at a high level per today. Actually, from 2008-2010 Norwegian industry did not use all of its emission-quotas (Statistisk Sentralbyrå 2011*a*). The wood-processing industry emitted 0.2 million tonnes CO_2-equivalents less than their permitted free quota given to them.

The excess demand of quotas that we have seen until today have caused the price of one quota to be low, and can be assumed to not stimulate much sustainable development, which is the emission trading system's intentions. If the total size of quotas is reduced, which seems to be the only alternative if one wants the emission trading system to function properly, then the price of a quota is also likely to rise. This will influence the non-integrated supply chain, as they either will have to buy quotas if they exceed their emission quota, or they have to invest

in newer and greener technology in order to reduce their emissions. As the quotas will be harder to obtain, and the cost increases, it might turn out to be more profitable to invest in more environmental technology. As far as we are concerned, the carbon emission trading system represent an external threat for the non-integrated supply chain, as there might be a cost increase for them if regulations become stricter after the next part of the Kyoto Protocol.

Do we have a public sustainability report that is informative for the reader?

Of the companies we have studied so far in this paper, it is only NORTØMMER that does not have a sustainability report. In the pulp and paper industry having a public sustainability report seems to be a must, especially for the European and North-American firms. This increases transparency, and the companies use it to report their goals, achievements and ongoing projects related to the environment. The report from Norske Skog is informative, and they report the same numbers year after year. They have been awarded for their openness around sustainability reporting, and for an external reader it is not very difficult to understand their measures and which actions they are focusing on. IKEA published its first sustainability report in 2007, and since then it has increased a lot in size. However, a problem for an external reader is that they do not always follow up with the same numbers year after year. There is also a lot of information, and it might be difficult to understand what IKEA requires from their suppliers and what they prefer.

UPM's report is large, as it is for their entire corporation. This implies that they do not cover in details their paper production, but mainly focus on the success stories and the big projects they are working on. This makes it harder to compare UPM with for example Norske Skog, as they do not provide the same overview of their targets and measures. Stora Enso is doing this better, as their annual report provides for example a table summarizing the most important parameters concerning environmental performance. However, maybe the most viewer friendly reporting is done by Cascades, who this year (2011) has chosen to publish a performance indicator table on their web page which easily provides the key parameters for their environmental measures.

In general, the non-integrated supply chain has well-documented reports. However the IKEA-report is still confusing, and do not give an extensive amount of valuable information about the catalogues and their environmental profile. There are other companies that have better and more reader friendly practices that should be considered for the non-integrated supply chain as well.

Is our supply chain transparent and how do we control that our suppliers fulfill our environmental requirements?

To become a supplier for IKEA one must adhere to their IWAY requirements in addition to industry specific requirements. They control if their suppliers follow these requirements by sending out questionnaires, and from 2010 they started to conduct systematic audits of their suppliers. For their sub-suppliers IKEA has no such controls or checkups. The non-integrated supply chain is consequently not very transparent and the different actors have relatively little control over each other. This is a clear weakness.

Since the non-integrated supply chain lacks transparency it also faces the risk of having suppliers and/or sub-suppliers that are not reporting correctly and who might be breaking environmental requirements and preferences. If breaches of environmental requirements and preference are discovered by other stakeholders, it might hurt the reputation of all the players in the non-integrated supply chain severely and even destroy it. We will therefore consider this as a threat for the non-integrated supply chain.

Do our suppliers use internationally recognized environmental reporting system?

NORTØMMER is a small company and uses no internationally recognized environmental reporting system. Norske Skog reports after the GRI principles, which is the world's most widely used sustainability reporting framework. IKEA explores the possibility to develop global supply chain standards through their partnership with GSCP. As one can see, there exists no consensus on their environmental reporting between the different companies in the non-integrated supply chain. This might therefore be considered a weakness, since it makes the supply chain inefficient in their environmental reporting.

Green design

Is green design implemented in our product development process?

For NORTØMMER and Norske Skog there was no available information about any product development processes with an environmental focus for their products. As our discussion mentioned, UPM is continuously developing new paper products that are more environmentally friendly. Even though IKEA just recently changed their product design to a more environmentally friendly edition of its catalogue, it is clearly a weakness for the non-interated supply chain that Norske Skog is not developing greener paper, while its competitors are. Also, IKEA mainly focused on weight and volume, which is just a small part of the design.

Do we use environmentally friendly materials?

Trees are a renewable raw material, and hence the paper supply chain can potentially be quite green. However, if the forests are not sustainably managed the result is deforestation and increased greenhouse gas emissions. In the non-integrated supply chain NORTØMMER is 100 per cent PEFC certified, and a few of their members are also FSC-certified. Norske Skog and IKEA also state that they prefer to only buy certified fibre to ensure sustainable forest management. 76 per cent of Norske Skog's fibre is certified and 20 per cent of IKEA's catalogue suppliers are providing them with FSC-certified fibre. Other raw materials that are possible to use are recycled paper or chemical pulp, which are more environmentally friendly than alternative options. Norske Skog uses 34 per cent of recycled fibre in their production, but the catalogue paper that they are supplying IKEA does not include recycled fibre as Saugbrugs only uses fresh fibre in their production. We are aware of that IKEA uses TCF paper for the catalogue, which is positive; however in general there are big opportunities for this supply chain if they focus more on the degree of environmentally friendly materials they are using in their production.

Do we have environmental innovations for our products?

Environmental product innovation does not seem to be Norske Skog's focus area when trying to reach their emission reduction targets. From their annual report there is no indication that their paper innovations have an environmental focus. UPM has on the other hand just invented a new uncoated catalogue paper based solely on recycled paper, which they claim is of good quality. Cascades is also focusing on the environmental aspect when designing their products, and hence have a large list of paper types that is included in an "Environmental" group. For the non-integrated supply chain green product development do not seem to be a large focus area. As the possibility for customers to procure greener paper products gets wider known, the demand might increase and hence those not having such a product to offer might lag behind. Still it seems like it is mainly the green frontrunners in the industry that have a focus on environmental innovations for their products.

IKEA just redesigned its catalogue, and does not seem to have immediate plans to further improve its design. It is now up to their suppliers to improve their processes in order to get it greener. One of them is Norske Skog, and environmental innovation is therefore an opportunity for the non-integrated supply chain.

Green packaging

Can our customers easily identify the environmental requirements that our products fulfills?

Along with the deliveries from NORTØMMER follows papers declaring which requirements they fulfill. Neither Norske Skog nor IKEA have a system in place that gives the customers easy access to information regarding the environmental impact of their product. UPM on the other hand, has recently committed to label all of its products with information about the environmental impact of that exact product. Cascades is even more transparent as they have an environmental calculator on their webpage which easily measures the environmental impact of the exact order that a customer wants to place (Cascades Papers, 2011.1). However, another competitor, Stora Enso does not have such information easily accessible for its customers either.

IKEA is not using any other labels than their own and claims that it should be sufficient enough for their customers, as they are trying to build their brand around an image of being an environmentally friendly company. However, for customers to know which environmental certifications which are behind an IKEA product, the IKEA logo is of little information.

Being as transparent as Cascades and UPM is not the rule, but more the exception, and it is therefore not conceived as an external threat. In general the non-integrated supply chain system is not well labeled and it is therefore hard for external stakeholders to know exactly which environmental impact a product has since there is no specific labeling following the product.

Are our products packed in environmentally friendly material?

Regarding packaging there was no information about what the different participants used. It is therefore hard to say if it is a strength, weakness, opportunity or threat. But if no public information implies that they are not thinking green when it comes to packaging, they are overlooking an important opportunity to making the entire supply chain system greener. It might be mentioned that IKEA is conscious about their packaging for their furniture supply chain, but does not mention it for their catalogues.

Is the package design of our products designed so that packaging is more efficient?

The catalogue was recently redesigned to a smaller format, and hence packaging is more efficient and it does not require as much space when transporting it as the previous format. This is a strength for the non-integrated supply chain, as it improves its greenness.

Green procurement

What is our share of certified forest?

NORTØMMER offers all its members free PEFC certification in line with the Norwegian standard, and hence all of its members have this certification. They also offer their members help with achieving the FSC-certification, even though there is not a Norwegian standard for it yet. Currently just a small handful of their members have requested the FSC-certification, as demand for FSC-certified wood is fluctuating and not very high.

Norske Skog has a goal of using 100 per cent certified fibre. In 2010 this share was 76 per cent. Most of their certified wood is PEFC-certified, but they also source a smaller share of FSC-certified wood. The wood that is not certified comes from sustainably managed forests, which implies that they are managed according to national laws and regulations. As discussed above, IKEA only recognizes the FSC-certification. By 2010 only 21 per cent of their catalogue suppliers are FSC CoC-certified. Still, they have seen a growing trend in just the last few years, and it seems like IKEA is working actively to influence its suppliers to get their forests FSC-certified. If this work continues, the non-integrated supply chain has a good opportunity to become even greener. Both Norske Skog and IKEA are big enough to influence their suppliers to become more environmentally friendly. In general the supply chain's share of certified forest is large, and can be regarded as a strength.

Do we use chain-of-custody to trace our products origins?

Yes, both Norske Skog and IKEA have a CoC-certification for their products, and are therefore able to trace the raw materials origin. This is also quite common in the rest of the industry, as having knowledge about the wood's origin often is requested by legal authorities.

Green production

Do we produce at full capacity?

In 2010 Norske Skog reported that they produced at 89 per cent of their full capacity. Since we know that they in 2007 had a capacity utilization of 95 per cent, there is still room for improvements. However, they had a substantial increase from 79 per cent utilization in 2009,

so it is a positive trend we are seeing. UPM's annual reports and other industry participants do not say anything about their capacity utilization. It is therefore difficult to know if Norske Skog's capacity utilization is a weakness or strength.

Can we use more alternative energy sources?

Most of the greenhouse gas emission that arises from the pulp and paper industry comes from the energy that they produce or purchase to operate their mills. Since the paper production is a very energy consuming process, the companies can reduce their greenhouse gas emissions significantly by reducing their consumption or by using more alternative energy sources.

In 2010 Norske Skog's energy consumption was made up by almost 50 per cent electrical energy, 16 per cent fossil fuels, 14 per cent biofuels, 9 percent heat recovery from the TMP process and 7 per cent from other sources such as geothermal energy and steam. In other words, almost 66 per cent was non-renewable energy. In comparison, UPM claims that 70 per cent of their energy consumption is from carbon dioxide-neutral energy sources, which is almost twice as much as Norske Skog. Norske Skog's share of energy from biofuels is relatively low, and they do not even have a share for energy produced from biomass. As the largest energy source for biomass is wood and the second largest is waste, there awaits big opportunities for the companies within the pulp and paper industry to increase their share of alternative energy sources. Instead of sending their waste to landfills, one can reuse it by using it to produce biomass energy. With a share of only 14 per cent, Norske Skog has a potential to increase their share significantly, and we will therefore consider alternative energy sources as an opportunity for Norske Skog.

Do we measure our water usage?

Norske Skog has a large focus on water usage as the paper producing process needs a large amount of water. They measure their water usage, and focus on not consuming the water but just using it and returning it back to its natural cycle after treatment. In general, it seems like the trend in the pulp and paper industry to focus consumption and treatment. Most companies have made large reductions in their water consumptions the last couple of years.

IKEA also measures water consumption, and publish the total water consumption for their catalogue production as well as consumption per copy. This makes it easy to track the changes over the years. The openness around water usage throughout the supply chain and the knowledge of the amount of water used per catalogue is positive, and is regarded as a strength of this system.

How do we treat the water after using it for production?

After using the water for production Norske Skog cleans it and returns it to the natural water circle. In the treatment process they remove solid particles and dissolve organic material before returning it. Compared to UPM, Norske Skog does not seem to measure the effluent quality, but otherwise they are quite similar. Compared to its rivals, Norske Skog, the producer in the non-integrated supply chain, does not seem to have any special measures in place for water treatment. Since IKEA is not producing any of the catalogues at its own facilities they do not have special treatment programs in place. It seems like the water treatment practices are similar throughout the industry, and therefore Norske Skog's measures cannot be regarded as a strength, nor a weakness.

How do we dispose our waste?

An important environmental parameter is how much waste that goes to landfill. The amount of this should be reduced if one is minimizing the environmental impact of production. Norske Skog had an increase in their waste to landfill per tonne over the last few years, although saying they are focusing on reducing it. The waste that does not go to landfill is used in different ways, like producing biofuel, and using the ash to make bricks and concrete. In comparison UPM has had a decreasing trend of their total waste to landfill, and made several investments that have made it possible to dispose their waste differently. They also inform that as much as 90 per cent of their production waste is reused or recycled. IKEA does not have any public information specifying waste to landfill following the production of their catalogues. We consider Norske Skog's increasing share of waste to landfills per tonne as a weakness, since some of their rivals are reducing their share of waste to landfills.

Is investing in more environmentally friendly production equipment a focus area?

One of Norske Skog's main strategies to reduce greenhouse gas emissions is to invest in equipment that will reduce emissions, for example energy reducing equipment. 2009 was a year of large investments, but due to an economic downturn that year, the following year had much smaller environmental investments. Obviously Norske Skog is aware of the importance of making long term environmental investments. However, it seems to be one of the first areas to cut down if there is an economic downturn, indicating that they do not regard environmental investments as something that might generate profits. This can be a threat for the non-integrated supply chain, as the lack of green investments might make them lag behind their main competitor's environmental profile. It is important for the non-integrated supply chain to continuously improve their processes so that they keep their position in the market

where both customers, governments, environmental organizations and international initiatives are demanding a greener production.

Green Logistics

Which types of transportation modes do we use and how much of each type?

All three companies use trucks, trains and ships for transportation. Norske Skog and IKEA also report the amount they use of each transportation mode. Norske Skog has a relatively high share of trucks (83 per cent for raw materials and 50 per cent for finished products), however they also uses trains to some extent (10 per cent for raw materials and 20 per cent for finished products) which is considered one of the most environmentally friendly transportation mode. IKEA also uses a high share of trucks as transportation, but their train share is only two per cent.

A few of Norske Skog's competitors such as Stora Enso and SCA also reports amounts they use of the different transportation modes. According to Stora Enso's Sustainability Report (2010), they only use trains for two per cent of their transportation, which is a much lower share than Norske Skog. Altogether, it seems like the majority of the pulp and paper companies do not report the amounts used and it is therefore difficult to know if the non-integrated supply chain is more environmentally friendly. However, one can assume that there is a reason for why they do not report this, and it is likely to be because they have low shares of environmentally friendly transportation modes. Consequently, one can presume that the choice of transportation mode in the non-integrated supply chain is a strength because of the relatively high shares of environmentally friendly transportation modes compared to their competitors.

Are we facing any pressure from governments, media or environmental organizations to use more environmental friendly transportation modes?

Norske Skog recently received criticism from Friends of the Earth Norway (Naturvernforbundet) in Østfold regarding what they believe is excessive use of trucks from the mill Saugbrugs to their harbor. Many politicians have also expressed that they think Norske Skog should build a railway between the harbor and Saugbrugs. In the future pressure from environmental organizations and possible new legislations from local politicians, might force Norske Skog to build a new railway. This is a threat Norske Skog are facing in their local environment.

Which decisions do we base our choice of transportation modes on?

According to Bergsaker (2011), NORTØMMER bases their transportation decisions on what is more profitable instead of choosing the most environmental responsible option. Norske Skog says that they base their transportation decisions on both an economical and environmental perspective. IKEA claims that they chose rail transportation where possible when it is the more environmentally friendly option. It seems like the general trend for companies is claiming to take the environmental perspective into consideration, but in the end their choice is mainly based on what it the most economically viable alternative. In the future the supply chain might profit from taking the environmental aspect also into consideration when choosing transportation mode.

What is our filling rate?

Neither NORTØMMER nor Norske Skog give any public information about their filling rates. IKEA reported that they had a filling rate between 60 - 64 per cent in 2010. Except from IKEA, it seems like it is quite unusual for other companies to report their filling rates.

What are our greenhouse gas emissions from transportation?

NORTØMMER has no public information of their greenhouse gas emissions from their transportation use. In 2010, Norske Skog's greenhouse gas emissions amounted to 10 000 tonnes CO_2-equivalent for their internal transportation and mobile sources. IKEA estimated that their CO_2 emission from goods transportation in 2010 was 580 000 tonnes. Very few companies report their total greenhouse gas emission from both internal transportation and transportation use from the entire supply chain, as most only measure scope one and two emissions. Presently, IKEA is along with WWF trying to calculate their scope three emissions; however the calculations are very inaccurate. Still, they indicates that a company's true emissions is larger than it appears if only scope one and two is included, as scope three also covers external transportation. Since it is not easy to obtain company's emissions from transportation, it is difficult to know if the non-integrated supply chain has low or high greenhouse gas emissions from their transportation.

Recovering, Reusing and Recycling

What is our share and amount of recovered fibre material in our production?

Norske Skog's and IKEA's shares of recovered fibres were 34 per cent (1.5 million tonnes) and 11 per cent (11.300 tonne) in 2010. European companies normally have shares between 20 and 50 per cent which represent volumes from one to four million tonnes. Hence, Norske

Skog has neither the highest nor the lowest shares and volumes of recovered fibres. However, IKEA has both a low share and volume. One can therefore consider this a weakness for the non-integrated supply chain.

Do we report the share of recovered fibres that we use in our products?

Neither Norske Skog nor IKEA report nor label their products with the share of recovered fibre used in that particular product. However, it seems like this is something which is not common in the pulp and paper industry. One might therefore consider this an opportunity for the non-integrated supply chain.

Do we invest in research for alternative use of our forest residues, organic waste and rejected recycled fibre etc.?

NORTØMMER is currently involved in the Norwegian company Bio Oil AS, while Norske Skog previously was involved in Xynergo AS a project which ended in 2010 due to lack of further investments. Some of Norske Skog competitors such as UPM, Stora Enso, SCA and Sappi have been, or are currently researching and investing in similar projects. We consider investments that lead to the development of this technology as an opportunity since it has the potential to revolutionize both the energy and the fuel market.

Do we use our thermal energy recovered from the TMP process for production?

Nine per cent of Norske Skog's energy consumption came from thermal energy recovered from the TMP process in 2010. Few of Norske Skog's competitors report their use of thermal energy recovered from the TMP process and one can therefore assume that most companies have relatively low use of this type of energy. UPM, which is the world's largest producer of graphic papers, received 1.7 per cent of their energy from the TMP process. Norske Skog's share is more than five times higher than UPM which is considered a larger company than Norske Skog. Consequently, one can consider Norske Skog's use of thermal energy as strength.

How much of the water which we use do we recycle and reuse?

Norske Skog recycles and reuses 96 per cent of the water they use. IKEA on the other hand does not report their supplier's recycle and reuse share. Again, there are not that many companies which report their water recycle and reuse share. However, the few companies in Europe which do report their share, reports that they have a recycle and reuse rate of 90 per cent or higher. One can consider it a weakness that IKEA does not report their share; however it is Norske Skog who is the producer and therefore the company who has the biggest

consumption of water in this supply chain. Therefore we consider their water recycle and reuse rate as a strength since it is relatively high.

How much of our waste do we recycle and reuse?

Norske Skog and IKEA both recycle and reuse 90 per cent or more of their waste. Most European companies have high recycle and reuse shares of their waste, as a consequence of the high taxes and strict legislations in Europe. In other regions of the world companies can still send large volumes of waste to landfills, such as in Chile. The Chilean company, CMPC sends a total of 82.4 per cent of their waste to landfills. One should therefore be aware of the possibility that the authorities in these regions might impose new taxes and legislations in the future and make it harder to send waste to landfills. In other words, this might be a threat for the non-integrated supply chain since they have operations in these regions.

9.1.1 Summary of the findings from the SWOT-analysis

Figure 9.a: SWOT Matrix

Strengths	Weaknesses
Green Supply Chain Management - Cooperation with non-profit environmental organizations ***Green Procurement*** - Share of certified forest ***Green Packaging*** - Catalogue format ***Green Production*** - Openness around water usage ***Green Logistics*** - Transportation modes ***Recovering, Reusing and Recycling*** - Thermal energy share - Water recycle and reuse share	***Green Supply Chain Management*** - Transparency - Environmental reporting systems ***Green Design*** - Green design ***Green Packaging*** - Lack of environmental labels on their products ***Green Production*** - Sub-optimal production - Increased amounts of waste to landfills per tonne ***Recovering, Reusing and Recycling*** - Recovered fibre share in total production
Opportunities	**Threats**
Green Supply Chain Management - Increasing demand for green products - Easy access to environmental parameters ***Green Design*** - Use more environmental friendly materials - Environmental innovations for their products ***Green Packaging*** - Environmental packaging solutions ***Green Production*** - Alternative energy sources ***Green Logistics*** - Decisions basis for use of transportation mode ***Recovering, Reusing and Recycling*** - Reporting and labeling of recovered fibre share in their products - Investments in bioenergy and biofuel	***Green Supply Chain Management*** - Declining demand for catalogues - Environmental organizations may not perceive IKEA catalogue as green product - Increased prices for emission-quotas - Suppliers and sub-suppliers that are not reporting correctly, and is discovered to be breaking environmental requirements ***Green Production*** - Lack of investments in more environmentally friendly production equipment ***Green Logistics*** - Outside pressure for higher usage share of environmentally friendly transportation modes ***Recovering, Reusing and Recycling*** - Waste recycle and reuse share

9.2 TOWS-Analysis

We have now identified our supply chain's strengths, weaknesses, opportunities and threats and will use them to identify some key environmental strategies by conducting a TOWS analysis. By using the characteristics found in the section above we have combined them with the internal and external factors that have been mentioned and made different strategic options.

Strength – Opportunity Strategies

The non-integrated supply chain has quite high shares of certified forest and has made size adjustment to the catalogue which has beneficial impacts on the environment. As the demand for green products increase, a green supply chain should focus on developing greener products by using more environmentally friendly material and utilizing alternative energy sources for production. A strength for the non-integrated supply chain is that they are relatively open around several of their key performance indicators like energy use and water reuse share, which is possible to find in their sustainability reports. A possibility will be to make these numbers even more accessible so that customers do not have to do calculations on their own, or read through the entire sustainability report to get information about the environmental impacts of each product. Since they in many areas have a relatively high environmental performance they should emphasize these characteristics for their customers.

Strength – Threat Strategies

Environmental organizations and other stakeholders might pose the biggest threat for the non-integrated supply chain, as they can put pressure on the supply chain and cause negative attention around the supply chain system and the companies that participates in the supply chain which might damage the company's reputation. For an industry that is experiencing a decline in demand such attention is not wanted.

Environmental groups and other stakeholders are continuously scrutinizing the forest and paper industry to check if there is any misbehavior that has a negative influence on the nature and environment. Recent cases have proven that although companies claim to have an overview of their activities this might not always be a case. That some sub-supplier might not be reporting correctly pose a constant threat that there should be more awareness on. It seems like sub-suppliers are not always monitored thoroughly, and they should therefore put a larger effort in getting a complete overview so that the risk of discovering misbehavior at one or more of the sub-suppliers will be reduced. A strength in this supply chain is their relative openness around their environmental performance, and they are also performing well in terms of the usage of transportation modes as well as their share of certified forest. The different companies participating in the supply chain also cooperates with environmental organizations, and should use these relations to improve the areas of the supply chain that might not have a satisfied level of greenness. This will also neutralize the threat of higher prices on emission quotas that might be the reality in the future, as green improvements along the supply chain will reduce emissions and hence the need for a large quota. In addition, green supply chain

management will most likely be more important in the future, and it might be necessary to focus on it in order to not fall through in a competitive market. By more actively trying to use its relationships with environmental organizations to improve their greenness they can become a stronger supply chain.

Weakness – Threat Strategies

A weakness in the supply chain is the lack of transparency, and a threat is that environmental organizations might discover misbehavior by suppliers and sub-suppliers that the companies participating in the supply chain were not aware of. To minimize this weakness the non-integrated supply chain should consider dismissing the suppliers that are not able to fulfill the requirements related to the reporting systems. They should also put in place improved reporting systems and make sure the same system is used all through the supply chain so that transparency is increased. This will make it easier to discover misbehavior, and to compare different units. They will more easily know what to do if there in one or more regions are imposed new taxes and legislations on for example waste going to landfill. By establishing a more transparent reporting system they will have a better overview of their supply chain and hence avoid the threat that environmental organizations might discover misbehavior and create attention around it, and by this damaging the reputation of the non-integrated supply chain.

Weakness – Opportunity Strategies

The lack of focus on green design in the non-integrated supply chain is a weakness that should be minimized. Awareness around green design will make the product development greener, which potentially can have large impacts on the entire supply chain. Seeing that there is an increase in demand for green products they have the potential to utilize this opportunity, and then minimize its weakness. New innovations today makes it possible to use more environmentally friendly materials and alternative energy sources for production.

To be able to capture the consumers who demand green products they should consider labeling their products with the environmental certifications it fulfills. The end customer will then be made more aware of the environmental impacts the product they are considering buying has, and capture the environmentally conscious consumers more easily. The less research a consumer will have to do to determine the greenness of the product, the better it is. Also, by highlighting its positive attributes, it will make the product more attractive for consumers.

9.2.1 Summary of the findings from the TOWS-analysis

Figure 9.b: TOWS Strategic Alternative Matrix

Strength – Opportunity Strategies		Strength – Threat Strategies	
Green Design - Catalogue size ***Green Procurement*** - Share of certified forest ***Green Production*** - Openness around water usage ***RRR*** - Water recycle and reuse share	***GSCM*** - Easy access to environmental parameters ***Green Design*** - Use more environmentally friendly materials - Environmental innovations for their products ***Green Production*** - Increasing demand for green products - Alternative energy sources	***GSCM*** - Cooperation with non-profit environmental organizations ***Green Procurement*** - Share of certified forest ***Green Logistics*** - Transportation modes ***Green Procurement*** - Share of certified forest ***Green Production*** - Openness around energy use - Openness around water usage ***Green Logistics*** - Transportation modes	***GSCM*** - Declining demand for catalogues - Environmental organizations may not perceive IKEA catalogue as a green product - Increased prices for quotas - Suppliers and sub-suppliers that are not reporting correctly, and is in reality breaking regulations ***Green Production*** - Lack of investments in more environmentally friendly production equipment
Weakness – Threat Strategies		**Weakness – Opportunity Strategies**	
GSCM - Transparency - Environmental reporting systems	***GSCM*** - Suppliers and sub-suppliers that are not reporting correctly, and is in reality breaking regulations	***Green Design*** - Green design ***Green Packaging*** - Lack of environmental labels on their products ***RRR*** - Recovered fibre share in total production	***GSCM*** - Increasing demand for green products ***Green Design*** - Use more environmentally friendly materials ***Green Production*** - Alternative energy sources ***RRR*** - Reporting and labeling of used recovered fibre share in their products

9.3 Environmental Table

Below we are presenting our environmental table, with an overview of questions and where to find the relevant information regarding each question.

Green Supply Chain Management	**Page**
Do we expect an increase in demand for paper and catalogues in the future?	33-35
Do we expect an increase in demand for green products?	33-35
Is our product perceived as a green product?	33-35
Do we cooperate with any non-profit environmental organizations?	36-39
How, if any, do we measure our greenhouse gas emissions? And if you are measuring how many scopes do you include?	36-39
Is the carbon trading system influencing our business?	27-28
Do we have a public sustainability report that is informative for the reader?	77-78
Is our supply chain transparent and how do we control that our suppliers fulfill our environmental requirements?	77-79
Do our suppliers use internationally recognized environmental reporting systems?	77
Green Design	
Is green design implemented in our development process?	42-43, 59-60, 68
Do we use environmentally friendly materials?	42-43, 59-60, 68
Do we have environmental innovations for our products?	42-43, 59-60, 68
Green Packaging	
Can our customers easily identify the environmental requirements that our products fulfill?	43-44, 60, 68-69
Are our products packed in environmentally friendly material?	43-44, 60, 68-69
Is the package design of our products designed so that packaging is more efficient?	43-44, 60, 68-69
Green Procurement	
What is our share of certified forest?	44-47, 60-61, 69-71
Do we use chain-of-custody to trace our products origins?	44-47, 60-61, 69-71
Green Production	
Do we produce at full capacity?	48
Can we use more alternative energy sources?	48-49, 61-62, 72
Do we measure our water usage?	49-50, 62, 72-73
How do we treat the water after using it for production?	49-50, 62, 72-73
How do we dispose of our waste?	50, 63, 73
Is investing in more environmentally friendly production equipment a focus area?	36-39
Green Logistics	
Which types of transportation modes do we use and how much of each type?	51-54, 63-64, 73-74

Are we facing any pressure from governments, media, environmental organizations and etc. to use more environmental friendly transportation modes?	51-54, 63-64, 73-74
Which decisions do we base our choice of transportation modes on?	51-54, 63-64, 73-74
What is our filling rate?	51-54, 63-64, 73-74
What are our greenhouse gas emissions from transportation?	51-54, 63-64, 73-74
Recovering, Reusing and Recycling	
What is our share and amount of recovered fibre material in our production?	54-56, 64, 74-75
Do we report the share of recovered fibres that we use in our products?	54-56, 64, 74-75
Do we invest in research for alternative use of our forest residues, organic waste, rejected recycled fibres etc.?	56-57, 64-65, 75
Do we use our thermal energy recovered from the TMP process for production?	57, 65, 75
How much of the water which we use do we recycle and reuse?	58, 65, 75
How much of our waste do we recycle and reuse?	58-59, 66, 75-76

10. Conclusion

This master thesis has addressed the question of how the non-integrated supply chain NORTØMMER, Norske Skog and IKEA, has become greener, and compared it with the integrated supply chain, UPM, and best practices in the industry. Our intention has been to make a general framework for supply chain systems within the pulp and paper industry.

We have looked at different aspects of green supply chain management to find out what is and what is not being done to improve the environmental sustainability within the pulp and paper industry. After studying a non-integrated and integrated supply chain in this particular industry, we have developed a general framework which can be used as a strategic tool to identify environmental strategies for supply chains within the pulp and paper industry. Even though this framework is most suitable for the pulp and paper industry, it can be implemented for other industries as well, with some adjustments.

Green supply chain management is a rather new field and we realized that it is difficult to find good theoretical literature that covers the subject. What we have found of literature has been either very general or focused on concrete cases that either the companies themselves have informed about or stories from environmental organizations. Our intentions have therefore been to provide a practical environmental framework for an entire supply chain system, by looking at a case study from a particular non-integrated supply chain.

Our research have been challenging and to a certain degree confusing. An interesting finding is that most companies are very good at presenting the green measures they are doing, but neglect to say what they are not doing but should be doing. Also there are several international initiatives, organizations and reporting systems that each has their preferred way of measuring and recommending targets. Norske Skog reports after one standard, while IKEA prefers another standard. Some only approve one sort of forest certification while others approve several. These differences have made it difficult to compare the different companies we have been studying, as it was hard to obtain the same data from all of them.

Our results confirm that there is a great focus on acting sustainable throughout the industry, especially for the European and North-American companies. However, there are also a lot of improvements that can be done, and our studies shows that each company mainly has its focus on emission reductions within its own four walls. For example the focus on green design seems to not be of high importance for organizations although great improvements can be

achieved by thinking green from product development. A proof of this is the IKEA catalogue which changed its design to a more environmentally friendly format, being both less energy and water consuming. Also, even though transportation is one of the large contributors to the increasing greenhouse gas emissions, not all companies seem to have a clear focus on measures to reduce emissions from transportation.

We have in our project chosen to use only public information, except for one conversation with Erling Bergsaker in NORSKOG. The information we have based our project on is therefore the public information that we have been able to access online. There are two reasons why we chose to do it this way. First of all we had to set some boundaries for our project, and since we wanted to include several companies from the industry we realized it could be hard to extract the exact same information from the different companies in order to do a fair comparison. Secondly, and maybe more importantly, we are of the opinion that openness towards the public is vital so that customers and other external stakeholders can get the proper image of the company's operations and their products. This is important concerning a company's environmental actions, and we therefore preferred to base our analysis from the public eye's perspective.

The framework developed is a simplistic view of the non-integrated supply chain and the industry it is operating in. It does not consider every possible aspect of the supply chain, and hence a supply chain should not use only this tool to develop their environmental strategies. However, it gives a good indication of which strengths and weaknesses a particular supply chain has and what opportunities and threats it faces and how it can utilize this to become more environmental sustainable.

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